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REPORT ON POLLUTION OF THE HUDSON RIVER AND ITS TRIBUTARIES

Public Health Service
New York, New York

September 1965

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Report on

Pollution of the Hudson River and Its Tributaries

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U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service
Division of Water Supply and Pollution Control

REPORT ON

POLLUTION OF

THE HUDSON RIVER AND ITS TRIBUTARIES

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
DIVISION OF WATER SUPPLY AND POLLUTION CONTROL
REGION II
NEW YORK, N. Y.

SEPTEMBER 1965

101

"Often homeward bound commuters, crowded on the front end of a ferry boat on a hot summer evening, apparently enjoy the light spray of salt water carried aboard by the wind as the bow of the boat hits the passing waves. This is surely a situation where ignorance is bliss."

Stream Sanitation

Earle B. Phelps
Professor of Sanitary Science
at Columbia University

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SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1. Since the time of Henry Hudson, the Hudson River has served as a major resource for the population centers along its shores, providing water supply, an abundant fishery, waterborne commerce, a place for recreation and the simple amenity of being by the river side. The survival of New York City, the surrounding metropolitan areas, and the urban areas upstream, depends upon the restoration and the preservation of these most vital water uses. The area covered in this report is the Hudson River and its tributaries from the Federal dam at Troy to the Narrows in New York City. The Hudson River in this area is presently used for recreational and non-recreational purposes. Numerous yacht clubs, marinas and parks depend upon the Hudson River for their existence. It also provides water supply for 82,000 persons of Rensselaer, Poughkeepsie, Highland and Port Ewen. In the near future, it will also serve as an emergency source of water supply for New York City. It is a potential water supply for the 12,000,000 people of the burgeoning metropolitan areas of both New York and New Jersey.

2. The entire Hudson River, from the Albany-Troy-Rennsselaer area to the Narrows, can be categorically described as polluted. The pollution from the equivalent of more than 10,000,000 persons is discharged to the river in this area. 43% of this is discharged without any treatment or the equivalent of the waste of 4,217,000 people. 38% receive primary treatment. Two-thirds of the wastes discharged originate in the State of New York, and the remainder in the State of New Jersey. More than 50 industries discharge their waste to the stream. In addition, 22 Federal installations contribute waste, the equivalent of 82,000 persons to the river.

3. For recreational waters, it is recommended that the dissolved oxygen content be at least 5 mg/l and the coliform content not exceed 1,000 coliforms per 100 ml. During a survey in August of 1965, depressed dissolved oxygen conditions were found to exist throughout the area. Levels below 5 mg/l were found in the upper 60 miles of the stream. Values approaching zero existed immediately below the Albany-Troy-Rensselaer area. From Saugerties to Tarrytown values recorded averaged about 5 mg/l. Tarrytown to the Narrows showed a steady decline with a level of 3 at the George Washington Bridge. Lower levels occurred in the immediate harbor area and in the tributary areas of the East and Harlem Rivers and the Newark Bay and Kill Van Kull. In these tributary areas, levels of less than 3 mg/l were frequently observed.

4. High densities of coliforms were observed in the Upper Hudson exceeding 5,000 per 100 ml and reaching a peak of 50,000 below Troy. Levels in excess of 1,000 are common throughout the area from Hudson to the New York City line. Levels in the New York Harbor area exceed 5,000 and in many cases reach 20,000 or more per 100 ml. In the tributary area of the harbor, counts exceeding 20,000 are common.

5. The discharges of untreated and inadequately treated wastes interfere with the use of this stream for water supply, recreation and fish and wild life. The levels of dissolved oxygen and coliform density observed, were such as to render the use of the river hazardous for recreation or water supply.

6. For the River to serve the vast population and industry that depend upon it, and so that it may be used for the maximum water uses possible; it will be necessary to provide and maintain facilities to accomplish exceptionally high levels of waste reduction combined with effective disinfection. Such facilities must at least be the equivalent of the most efficiently built and operated secondary sewage treatment plant. Even higher levels of waste treatment may be required in certain cases. It must be recognized that periodic wet and dry periods will occur and remedial facilities must be designed to provide protection for such occurrences. All sources of combined storm water and sewage should be intercepted and provided with treatment. It is proposed that the following time table be put into effect:

1) Designs for remedial facilities will be completed by January 1, 1967;
2) Financing arrangements to be completed by April 1, 1967;
3) Construction started by July 1, 1967;
4) Construction completed and plants placed into operation by January 1, 1970;
5) Commensurate schedules should be adopted for the interception and treatment of industrial wastes and wastes from Federal installations;
6) Existing schedules calling for earlier completion dates are to be met; and
7) The problem of storm water overflows should be reviewed and a program for action be prepared for consideration by December 31,1968.

7. Pollution originating in the State of New York is endangering the health or welfare of persons living in the State of New Jersey; and pollution originating in the State of New Jersey is endangering the health or welfare of persons living in the State of New York and, therefore, is subject to abatement under the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 466 et seq).

INTRODUCTION

On the basis of requests from Governor Nelson A. Rockefeller of New York and Governor Richard J. Hughes of New Jersey, and on the basis of reports, surveys, or studies, in accordance with section 8 of the Federal Water Pollution Control Act (33 U.S.C. 466 et seq.), the Secretary of Health, Education, and Welfare called a conference in the matter of pollution of the Hudson River and its tributaries. Representatives of the States of New York and New Jersey and the Interstate Sanitation Commission were invited to participate in the conference with representatives of the Department of Health, Education, and Welfare.

This report is based on recent studies conducted under the supervision of the Department of Health, Education, and Welfare, in addition to data obtained from other Federal, State and local agencies.

We gratefully acknowledge the cooperation of the Water Resource and Public Health agencies of the States of New York and New Jersey, the Interstate Sanitation Commission county and municipal agencies, and other private and public groups in the conference area.

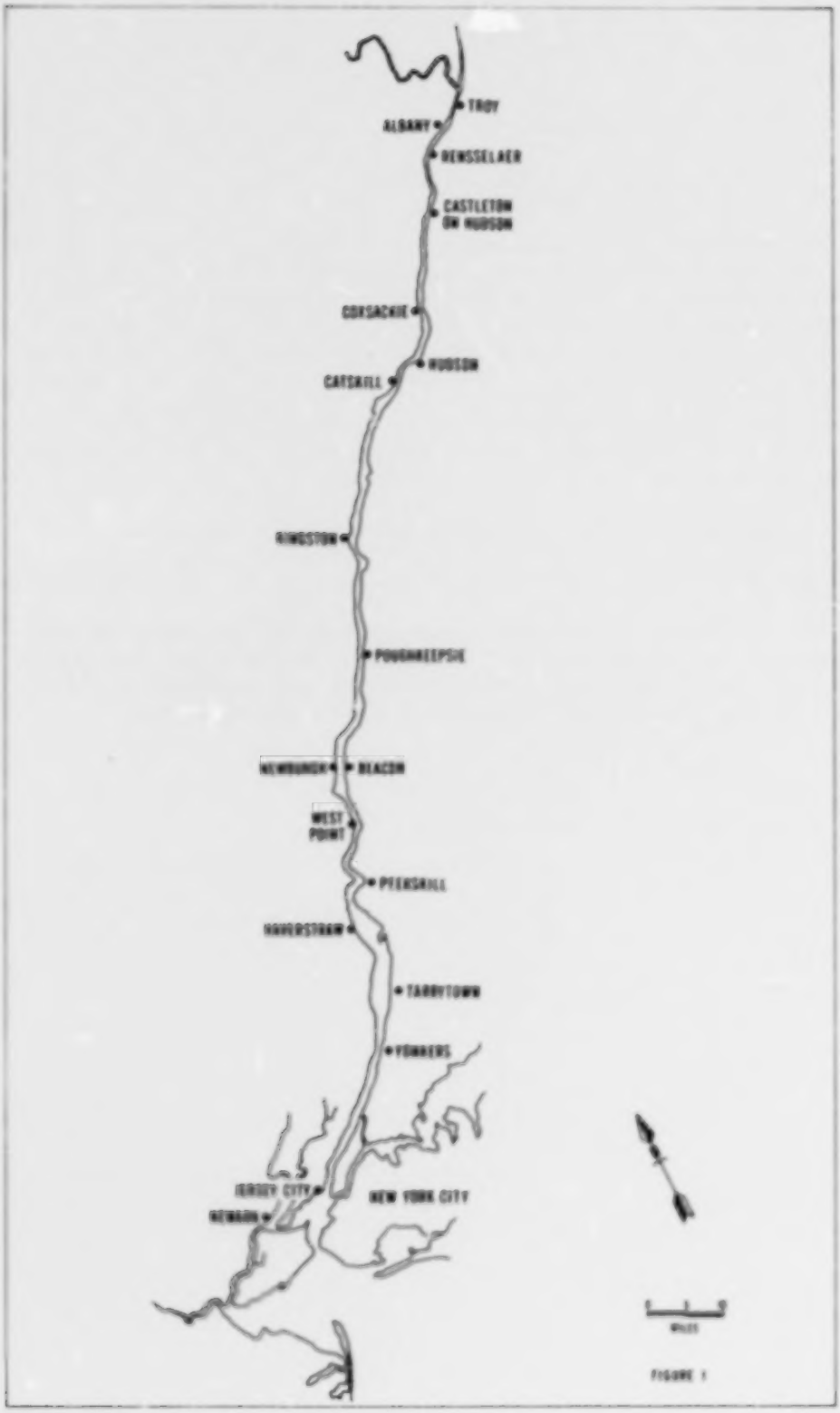
TROY
ALBANY
RENSSELAER
CASTLETON ON HUDSON
COXSACKIE
HUDSON
CATSKILL
KINGSTON
POUGHKEEPSIE
NEWBURGH
BEACON
WEST POINT
PEEKSKILL
HAVERSTRAW
TARRYTOWN
YONKERS
JERSEY CITY
NEWARK
NEW YORK CITY

FIGURE 1

DESCRIPTION OF AREA

General

The geographical area considered is shown in Figure 1. It encompasses the Upper Bay of New York Harbor, including Newark Bay, the Kill Van Kull, the East and Harlem Rivers and the main stem of the Hudson River from the Battery to the head of navigation at the Federal Lock at Troy, New York. All of the waters are maintained by the Federal Government as navigable waterways. The distance from the Narrows to the Battery is approximately seven miles, and the Hudson River extends another 151 miles from the Battery to the head of navigation at Troy.

The state line between New York and New Jersey in the conference area extends through the Kill Van Kull to the middle of Upper New York Bay. It then proceeds up the middle of the Hudson River to a point opposite Hastings-on-Hudson where it turns westward.

The area varies from the highly complex urban metropolitan region in and adjacent to New York City to essentially a rural section upstream, with the exception of the urban-industrial complex of the Albany-Troy-Rensselaer region.

The Upper New York Bay is considered the center of the New York Harbor complex. This basin is connected to and surrounded by four major water systems, each of which affects Upper Bay water quality in some manner. The largest and most important is the Hudson River, joining the Upper Bay at its northern extremity.

The East River is a tidal strait connecting the Bay and Long Island Sound. In the vicinity of Wards Island, the East River joins the Harlem River which, in turn, connects with the Hudson River at Spuyten Duyvil. Upper New York Bay is connected with Newark Bay by the Kill Van Kull. The two major tributaries of Newark Bay are the Hackensack and Passaic Rivers draining the northeastern portion of New Jersey.

The Narrows connects the Upper Bay with Lower New York Bay. Major tidal flow into the harbor complex is through this passage.

Agency Responsibilities

The New York State Department of Health and the New Jersey State Health Department are responsible for administering pollution abatement programs in their respective states. The responsibility for administer-

ing pollution abatement programs south of the Bear Mountain Bridge is shared by the Interstate Sanitation Commission, the New York State Department of Health and, in the interstate reach, the New Jersey State Health Department.

In 1936, the States of New York and New Jersey formed an interstate compact, which was later joined by Connecticut. The compact established classifications for recreational and non-recreational uses and set both effluent and stream standards for the attainment of these objectives (Appendix B). The states set up the Interstate Sanitation Commission to enforce the standards and to report annually to the states on the status of pollution abatement in their mutually interstate waters. The Commission can require compliance of any local governmental body within its jurisdiction by legal procedures and has done so in a number of cases. The Commission is specifically authorized under Article XII of the Compact to develop an overall plan of pollution abatement for the waters of concern.

The New York State Water Resources Commission, successor to the Water Pollution Control Board, has classified the waters of the Upper Hudson and prepared a comprehensive plan for the abatement of pollution in the River. The plan was adopted in 1955 and contains specific provisions and recommendations for each municipality and industry concerned. The procedure for implementing the plan consists of two phases: a cooperative phase and an enforcement phase. The enforcement phase requires legal action by the State against the offending polluter.

The State of New York in cooperation with the Interstate Sanitation Commission has established compatible classifications in the area of joint jurisdiction (Appendix A) and has adopted a comprehensive plan with specific recommendations and scheduling of projects to accomplish the objectives.

The New Jersey State Department of Health has declared that in waters under both its control and the Interstate Sanitation Commission, the requirements of the Tri-State Compact apply and it has conducted its program of pollution abatement in the Hudson River basin accordingly. The state has adopted a classification procedure for the waters under its jurisdiction but has not yet classified its waters covered by this report.

Hydrology

Water storage in the Hudson River Basin upstream of Troy, New York, totals nearly 1,700,000 acre feet. About half of this storage is used for

hydroelectric power production and the remainder for water supply, navigation, flow regulation, and recreation.

Approximately 60 percent of the total drainage basin of the Hudson River is upstream from the Federal Dam at Troy. This area is about 8,100 square miles with a regulated portion of about 30 percent or 2,450 square miles. Stream gauging records at Green Island upstream from the Troy lock show the average annual flow to be 13,060 cubic feet per second (cfs). An additional 5,300 square miles are tributary to the river from Green Island to the Battery. Pro-rating flow on a square mile basis, the average annual discharge of fresh water at the Battery would be 21,800 cfs from the total drainage area of 13,400 square miles.

Upstream flow regulation results in increased summer flows. The most probable once in 10 years minimum monthly regulated discharge in the Lower Hudson River is 4,700 cfs, and the minimum weekly 3,000 cfs. The present extended drought has produced critical conditions of extreme low flow in the river. For example, during the summer of 1965, minimum daily mean flows in the order of 1,600 cfs have been recorded at the Green Island gaging station.

Tidal action has a mean range of 2.9 to 4.4 feet in the Upper Bay. Tidal influence in the Hudson River extends upstream to the Federal Dam at Troy and affects the entire area. Tidal ranges from the Battery to Troy are shown in Table 1. The effects of salt water intrusion extends to West Point during normal flow and above Newburgh under extreme low flow conditions.

Flood currents in the Hudson from the Upper Bay northward are in the order of 1.4 to 3.0 feet per second (fps) and ebb currents 2.0 to 4.1 fps. Slack water occurs about 3-1/2 hours later at Bear Mountain and 7-1/2 hours later at Albany than at the Narrows. These distances are north of the Narrows about 53 and 152 miles.

The stream gradient in the Hudson River is very slight, dropping five feet in 150 miles. The river changes from a narrow, shallow stream at Troy to a broad and deep waterway at the New York City line. Virtually all fresh water entering the New York Harbor complex, with the exception of sewage and industrial wastes, is supplied by the Hudson.

There is no significant net flow in the East River. All water movement is due to tidal action and is oscillatory in nature. Fresh water flows enter the Harlem River from the Hudson River. Velocities are such that water entering the Harlem River from the Hudson River on an ebbing current will be carried to the East River. On the flooding current, water from the East River will flow to the Hudson through the Harlem.

The major flows into Newark Bay are the Hackensack and Passaic Rivers, which together have a relatively negligible fresh water flow during drought periods. Newark Bay does not have water depths at low tide of more than six feet except in the dredged channels. Without tidal flows, the area outside the main channels in Newark Bay would be practically stagnant. Net movement of waters in Newark Bay is to the Upper Bay through the Kill Van Kull rather than to the Arthur Kill.

Population

The area under consideration has a population of 12.3 million people. Eleven million, or 90%, are located in the New York - New Jersey metropolitan area. The remaining 1.3 million are located north of the Westchester County - New York City boundary line.

Population density varies widely throughout the area. It ranges from the rural density in Greene County of 48 persons per square mile to Manhattan with 77,000 per square mile in Manhattan. The major population center in the upper reach of the Hudson River is located in the Albany-Troy-Rensselaer region.

In general, counties within the area increased in population during the period 1950-1960. These increases ranged from 7.5% to 56.2%. One exception to this general trend was the five boroughs of New York City, which had a total population of 7,891,957 in 1950 and 7,781,984 in 1960, a decrease of 1.4%.

Economics

The Hudson provides navigable waters between the two metropolitan areas of New York City and Albany. Urbanization has moved north to Bear Mountain and is moving south from Albany. Additional urban centers are developing in the Kingston-Poughkeepsie area.

In the Upper Hudson River area the economic base is primarily agricultural, with manufacturing plants spread along the length of the river. In the Albany-Troy-Rensselaer area there is a concentration of commercial, industrial and residential development. In this upper river area, approximately 127,000 people are engaged in manufacturing operations.

The economic make-up of the New York-New Jersey metropolitan area is primarily commercial and residential with some industrial development. The industrial development in the New York City area includes oil refineries, manufacturing operations, processing plants and shipyards. Of the 446 types of manufacturing industries listed by the Federal

Table 1

HUDSON RIVER TIDAL RANGES

Locality	Mean Range of Tide (feet)[1]	Mean Range of Spring Tide (feet)
Battery	4.4	5.3
Spuyten Duyvil	3.9	4.7
Tarrytown	3.6	4.3
Peekskill	3.2	3.8
Beacon	3.1	3.8
Poughkeepsie	3.2	3.8
Rhinecliff	3.7	4.4
Tivoli	3.9	4.7
Hudson	4.1	4.9
Stuyvesant	4.2	5.0
Castleton	4.9	5.9
Rensselaer	4.9	5.9
Albany	5.3	6.4
Troy	5.5	6.6

[1]Based on records for July, August, and September 1950, adjusted to long-term mean at Fort Hamilton.

Bureau of Census, the Metropolitan area lacked only about 30 types in 1954 among the 50,000 plants in the region. Approximately 1.9 million people are involved in manufacturing operations within this area.

The New Jersey-New York Port is an area with 650 miles of usable waterfront. Along its shores are more than 200 piers capable of handling 400 ocean-going vessels at one time. Behind these piers are warehouses with 15 million square feet of floor space accommodating cargoes of every description.

WATER USES

Municipal Water Use

Present municipal water use of the main stream of the Hudson River is indicated in Table 2. The river, upstream from the area affected by salt water is used as a water supply by four communities serving a population of 82,000 people with a daily use of 10.7 million gallons. The majority of communities located along the river obtain their water supply from tributary streams, lakes or wells rather than from the Hudson River. Below Newburgh salinity increases and the water is not considered for use as a public water supply. The New York State Water Resources Commission has approved New York City's application for withdrawal of 100 mgd of water from the Hudson River at Chelsea to augment New York City's upland reservoir supply. When this occurs New York City will be the major user of the Hudson as a source of municipal water supply.

Plans are being formulated for use of the Hudson as a source of water supply for a group of communities in the Duchess County Water District. These plans represent an estimated expenditure of $27,000,000. The town and village of Rhinebeck are currently constructing a water supply system at a cost of $800,000. The source will be the Hudson and will serve approximately 4,000 persons. Representatives of the Ulster County Planning Board recently indicated that the county also may have to tap the Hudson River as its ultimate water supply.

The present water shortage has emphasized the value of the Hudson River as a source of water supply for the growing urban area downstream, including northern New Jersey.

Table 2

Municipal Water Supplies

Hudson River

Community	1960 Population Served	Av. Water Use mgd
Rensselaer, N. Y.	15,000	2.2
Highland, N.Y.	4,469	1.0
Port Ewen, N. Y.	2,622	0.5
Poughkeepsie, N. Y.	60,000	7.0
	82,091	10.7

This withdrawal was approved by the State Health Department as an emergency source with special requirements.

The City of Rensselaer has been ordered by the State Health Department not to use Hudson River water after April 1966. An agreement has been made with the City of Troy to serve Rensselaer.

Institutional Water Use

Two institutions in Duchess County, the Hudson River State Hospital at Poughkeepsie and the Castle Point VA Hospital at Chelsea use the Hudson River as a potable water supply source.

Industrial Water Use

From Troy to the New York City line, 32 industries use the Hudson River for industrial processing and cooling water. In the lower reaches the primary use of the river is for cooling purposes. For example, in the Westchester-Rockland County area, eight industries and steam generating plants use a total of 119 mgd for cooling water.

In the New York metropolitan area, the primary use of river and harbor water is for cooling purposes by steam generating plants and industries. Industrial use, exclusive of the New Jersey plants, amounts to 3,743 mgd from the Harlem and East Rivers, 165 mgd from the Hudson River, and 16 mgd from the Kill Van Kull.

Recreation

Extensive recreational use is made of the waters within the area under consideration, although poor water quality seriously limits most water contact activity. Plans are now being made by New York State through the Hudson River Valley Commission to expand the recreational use of the river. From Ellis Island north to Troy, along the Hudson River, there are a total of 87 private marinas and yacht clubs as listed in Table 3.

The large number of marinas and yacht clubs is indicative of the extensive use made of these waters for pleasure boating. Where such pleasure boating flourishes, there is an increase in water contact activity with a resultant increase in health hazards where polluted waters exist.

A list of public beaches and water front parks is given in Table 4. Of the 40 public parks in the area, 29 are in the lower portion below Croton-on-Hudson. These parks serve the concentrated population centers of Westchester County, Rockland County, New York City, and New Jersey contiguous areas.

Swimming is not authorized on the Hudson River downstream from Kingsland Point Park in North Tarryton. Other authorized swimming areas are Croton Point Beach and Nyack Beach State Park. However,

swimming is practiced at docks and piers and in many areas where natural beaches are found along this same portion of the river. Despite polluted conditions, there is unauthorized swimming along the Manhattan-New Jersey stretch of the river. The last beach that operated just north of the George Washington Bridge on the New Jersey shore was closed in the 1930's because of water pollution. Swimming is not authorized at the several recreational parks on the Manhattan and Queens shorelines of the Harlem and East Rivers and Upper Bay. However, swimming does occur to a limited extent in these areas.

Recreation in the Newark Bay and Kill Van Kull is limited to occasional sport fishing, more frequent pleasure boating, and some unauthorized swimming.

Each year the Staten Island Ferry carries an estimated million visitors to New York City between the Battery and St. George. In addition, four commercially operated sightseeing companies operate boats which travel around Manhattan Island. In 1959 it was estimated that they carried over a million tourists through the north end of the Upper Bay. Another 770,000 persons visit the Statue of Liberty each year. The unaesthetic stain of pollution upon these waters is thus observed at close hand by large numbers of people. In addition, air travellers utilizing all of the metropolitan airlines can readily observe this stain upon the face of the harbor.

The Hudson River, despite its present condition, is being used extensively as a recreational resource. However, present abuse has a limiting effect on its use and plans are now being developed to enhance the river to permit recreation on a more comprehensive basis.

This year the Hudson River Valley Commission was established to plan for the best use and conservation of the Hudson River as a natural resource. These activities include: finding ways to preserve the great scenic areas; investigating pollution; exploring the possibilities of zoning to help beautify the river; and encouraging boating and the water sports for which the river is suited, through the planning of new public and private marinas and launching facilities.

Improvement in water quality is an important factor in futhering development of the full potential of the Hudson river. This fact has been recognized and acknowledged by many governmental, civic and other local organizations.

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Table 3

Private Marinas and Yacht Clubs on the Hudson River

Between Ellis Island and Troy

Name	Location
79th Boat Basin-Hudson Harbor	New York City
Edgewater Yacht Club	Edgewater, N. J.
Riverdale Yacht Club	Riverdale, N. Y. C.
Englewood Yacht Basin	Englewood, N. J.
Ludlow Marine Corp.	Ludlow (Yonkers)
Mirsky's Outboard Marina, Inc.	Yonkers
Hudson Boat Club	Yonkers
Yonkers Corinthian Boat Club	Yonkers
Yonkers Yacht Club	Yonkers
Palisades Boat Club	Yonkers
Hastings Pioneer Boat Club	Yonkers
Tower Ridge Yacht Club	Yonkers
Dobb's Ferry Marina	Dobb's Ferry
Irvington Boat Club	Irvington-Yonkers
Cornetta's Marina	Piermont
Leach's Marina	Piermont
Shordine's Fort Comfort Yacht Basin	Piermont
Washington Irving Boat Club	Tarryton
Tarryton Marine, Inc.	Tarryton
Powell's Boat Yard	Nyack
Nyack Boat Club	Nyack
Julius Petersen Boat Yard	Nyack
Westerly Marina	Ossining
Selazzo Marine	Ossining
Shattemuc Yacht Club	Ossining
Rockland-Bergen Yacht Club	Haverstraw
Riverview Boat Club	Haverstraw
Croton Yacht Club	Croton-on-Hudson
Grassy Point Marina	Haverstraw
Minisceongo Yacht Club	Haverstraw
Ba-Mar Basin	Haverstraw
Seaweed Boat Landing	Stony Point Bay, Haverstraw
Montrose Yacht Club	Montrose, Haverstraw
Kings Ferry Marina	Greens Cove-Montrose, Haverstraw
Hudson Shore Marina	Verplanck, Haverstraw
Tompkins Cove Boat Club	Tompkins Cove, Haverstraw
Peekskill Yacht Club	Peekskill
See's Boat Yard	Peekskill
Garrison Marina	Garrison
Fort Montgomery Marina	Fort Montgomery
Cold Springs Boating Club	Cold Spring
Cornwall Yacht Club	Cornwall-on-the-Hudson

Private Marinas and Yacht Clubs on the Hudson River

Between Ellis Island and Troy (Cont'd)

Name	Location
Hanaford's	Newburgh
Newburgh Yacht Club	Newburgh
Dutchess Boat Club	Beacon
Chelsea Yacht Club	Chelsea
Macri's Marina	Middle Hope, Beacon
New Hamburgh Yacht Club	New Hamburgh
White's Hudson River Marina	New Hamburgh
Marlboro Yacht Club	Marlboro
Poughkeepsie Yacht Club	Poughkeepsie
Pirate Canoe Club	Poughkeepsie
Highland Marina	Poughkeepsie
Riverdale Boat Basin	Roosevelt, Poughkeepsie
Roger's Point Boating Association	Poughkeepsie
Norrie Yacht Basin	At Indian Kill, Poughkeepsie
Hidden Harbor	Port Ewen
Rays	Kingston
Ideal Marina	Kingston
Dwyer's Boat Basin	Kingston
Mid-Hudson	Kingston
Kingston Power Boat Association	Kingston
Lou's Boat Basin	Kingston
DuCraft Boat Basin	Kingston
Anchorage Rest	Kingston
Roundout Yacht Club	Kingston
Barrytown Boat Club	Barrytown
Saugerties Power Boat Association	Saugerties
Lynch's Marina	Saugerties
Maiden on Hudson	Saugerties
Roe-Jan Creek Boat Club of Linlithgo	Linlithgo Station, Catskill
Catskill Marina	Catskill
Hop-o-Nose Marine	Catskill
Catskill Boat Club	Catskill
Hudson Power Boat Association	Hudson
Athens Marine Center	Athens
Coxsackie Yacht Club	Coxsackie
Newton Hook Boat Club	Coxsackie
Ronnie's Marina	New Baltimore
Gerry Finke's Marina	Coeymans, Albany County
Ravena Coeyman's Boat Club	Coeymans, Albany County
Tri-City Yacht Club	Albany County
Castleton Boat Club	Castleton-on-Hudson
Albany Yacht Club	Albany
Rensselaer Marina	Albany
Boating Center	Albany
Tri-City Yacht Basin	Watervliet

Table 4

Public Beaches and Waterfront Parks in the Conference Area

NAME	LOCATION	OWNERSHIP
Shore Park	New York City	Municipal
Owls Head	New York City	Municipal
Liberty Island	New York City	Federal
Ellis Island	New York City	Federal
Battery Park	New York City	Municipal
Henry Hudson Memorial Park	New York City	Municipal
Riverside Park	New York City	Municipal
Ft. Washington Park	New York City	Municipal
Fort Tryon Park	New York City	Municipal
Inwood Hill Park	New York City	Municipal
Riverdale Park	New York City	Municipal
East River Park	New York City	Municipal
Queens Bridge Park	New York City	Municipal
Rainey Park	New York City	Municipal
Ward's Island Park	New York City	Municipal
Randall's Island Park	New York City	Municipal
Carl Schurz Park	New York City	Municipal
High Bridge Park	New York City	Municipal
Elysian Park	Hoboken	Municipal
Palisades Interstate Park	Fort Lee - Storm King	State
Tallman Mountain Park	Tallman	State
Boyce Park	Ludlow (Yonkers)	Municipal
Trevor Park	Glenwood	Municipal
Untermyer Park	Greystone	Municipal
Irvington Park	Irvington	Municipal
Kingsland Point Park	North Tarrytown	County
Memorial Park	Nyack	Municipal
Rockland Lake Park	Rockland Lake	State
Nyack Beach Park	Upper Nyack	State
Harmon Park	Croton on Hudson	County
Croton Point Park	Croton on Hudson	County
George Island Park	Crugers	Municipal
Fort Hill Park	Peekskill	Municipal
Downing Park	Newburgh	Municipal
Eastman Park	Poughkeepsie	Municipal
Wheaton Park	Poughkeepsie	Municipal
Pulaski Park	Poughkeepsie	Municipal
Norrie State Park	Staatsburg	State
Ogden Mills State Park	Staatsburg	State
Seamon Park	Saugerties	Municipal
Waterfront Park	Troy	Municipal
Van Schaick Island Park	Troy	Municipal

Commercial Navigation

The New York Harbor area and the entire Hudson River north to the Federal Dam at Troy are used for navigation. The total amount of waterborne commerce of the Port of New York amounted to 153,198,620 short tons in 1960. Navigation is presently a major use of the Upper Harbor and lower portion of the Hudson River. There are 90 piers in New York alone between the Battery and 72nd Street. Additional piers are located on the New Jersey side of the river. The Port of New York is the largest in the United States.

At the Port of Albany, N. Y., the total traffic for 1960 amounted to 6,990,978 short tons represented by a total of 5,267 vessel trips. At the Federal Lock at Troy, N. Y., with a navigation season running from April 21 to December 14, the total traffic amount to 3,353,429 short tons in 1960[1].

The Hudson River constitutes an important link in the New York State Barge Canal system. Commercial navigation from the Port of New York can travel via the Hudson River and the Barge Canal to Lake Champlain and the St. Lawrence Seaway in the north, or to the Great Lakes in the west.

Fish

Historically the Hudson River has served as a large resource for both commercial and sport fisheries. Data from the New York State Conservation Department, presented in Table 5, indicate a continual decline in the commercial fishing harvest in recent years, primarily attributable to a 50% reduction in the shad catch and a 65% reduction in the striped bass catch. At present, fishing in the river is not fully exploited because of a natural reluctance on the part of fishermen to work in and take fish from areas contiguous to the discharge of raw sewage.

[1] Waterborne Commerce of the United States - Calendar Year 1960, Department of the Army, Corps of Engineers.

Table 5

Commercial Catch in New York State Waters of Hudson River 1959-1963
(In thousands of pounds)

Species	1959 lbs.	1959 %	1960 lbs.	1960 %	1961 lbs.	1961 %	1962 lbs.	1962 %	1963 lbs	1963 %
Bullhead	2.4	0.3	0.9	0.2	0.7	0.17	0.2	0.06	0.6	0.2
Carp	11.9	1.5	15.5	3.9	6.6	1.6	11.3	3.2	10.5	4.1
Catfish	20.4	2.6	23.0	4.6	19.0	4.8	14.6	4.2	9.0	3.6
Eels	10.1	1.3	3.6	0.7	16.0	4.0	6.5	1.8	7.1	2.8
Herring*	45.6	5.8	38.2	7.6	33.8	8.5	38.2	11.0	32.3	12.8
Shad	538.7	69.4	273.9	54.8	236.5	60.0	218.2	63.1	132.5	52.9
Striped Bass	133.1	17.1	132.9	26.6	70.7	17.9	48.1	13.9	46.7	18.6
Sturgeon	3.3	0.4	3.8	0.7	2.3	0.5	2.5	0.7	3.2	1.2
Suckers	1.0	0.1	0.8	0.2	1.5	0.3	0.8	0.2	0.6	0.2
Sunfish	0.2	0.03	0.3	0.06	0.1	0.02	0.2	0.06	0.3	0.1
Tomcod	1.2	0.1	1.7	0.3	0.8	0.2	1.1	0.3	1.3	0.5
White Perch	8.4	1.0	4.3	0.8	6.3	1.5	4.1	1.1	5.8	2.3
Yellow Perch	0.4	0.05	0.4	0.08	0.1	0.02	—	—	0.6	0.2
Total Catch	776.7		499.3		394.4		345.8		250.5	

*Includes the Alewife, Alosa pseudohorengus and the Blueback herring, Alosa aestivales.

Hydro Power

The Hudson River is used at the Troy Lock and Dam as a source of power for the Ford Motor Co. plant at Green Island, N.Y. No other use is made for hydroelectric purposes within the limits of the conference area.[1]

[1] Lower Hudson River Report No. 5, New York State Department of Health.

CLASSIFICATION AND STATUS OF PROGRAMS

Classification of Waters

New York State has undertaken a program of classification of its streams to establish the best possible water usage. (Appendix A). The Interstate Sanitation Commission has classified waters under its jurisdiction. (Appendix B). New Jersey initiated its classification procedure in 1964 and has not yet classified their waters in the Area. However, it has declared that the requirements of the Interstate Sanitation Commission apply. The State has also stipulated that minimum treatment consist of sedimentation and chlorination in tidal waters.

New York State's classification of the Hudson River waters are as follows:

--From the Troy lock to the south of Houghtailing Island - Class C - fishing and fish culture.

--From the south end of Houghtailing Island to the southern end of Esaupus Island - Class B - bathing and general recreation.

--From the south end of Esaupus Island to the general area of Chelsea - Class A - water supply.

--From the Chelsea area to the Bear Mountain Bridge - Class B - bathing and general recreation.

--From the Bear Mountain Bridge to the New York-New Jersey state line opposite Hastings-on-Hudson - Class SB - recreation, fishing and bathing.

--From the New York-New Jersey state line to the Battery - Class I - fishing.

The classifications from Troy to Bear Mountain Bridge were adopted in 1954. Those from Bear Mountain Bridge to the Battery were adopted early in 1965.

In December 1964, classifications were adopted by the New York State Water Resources Commission for New York Bay and Raritan Bay which included the Kill Van Kull, Harlem River, and Lower East River subbasins. These official classifications are as follows:

--Upper New York Bay - Class I - fishing.

--Kill Van Kull - Class II - water not primarily for recreational purposes, shellfish culture or development of fish life.

--Lower East River (except for small sector at its southern end) - Class II-water not primarily for recreational purposes, shellfish culture or development of fish life.

--Harlem River from junction with Lower East River to Washington Bridge - Class II - water not primarily for recreational purposes, shellfish culture or development of fish life.

--Harlem River from Washington Bridge to junction with the Hudson River - Class I - fishing.

Classification by the Interstate Sanitation Commission, adopted in 1936, established Class A waters, for recreational use, from the Bear Mountain Bridge to the area of the George Washington Bridge on the Hudson River and the Washington Bridge on the Harlem River. The waters south of these points to the Narrows and the Outerbridge on the Arthur Kill were classified as Class B, non-recreational waters.

Status of Programs

Under the comprehensive plan adopted in 1955 by New York State for the upper Hudson River, a total of 17 municipalities, 20 industries and 10 institutions, representing 370,000 people, were required to commence abatement facilities of their pollutional discharges. Of the municipalities named, three have constructed and are operating primary treatment plants or additions to then existing, but inadequate plants. This represented a net reduction of 14% of the raw municipal sewage discharging in 1955. Three more municipalities representing 13% of the municipal discharges have plans for treatment. In September 1965, New York State initiated legal action against six municipalities with a combined population of about 250,000.

In 1947, the Interstate Sanitation Commission and New York City entered upon a "Consent Order" agreement. There were two major provisions to the consent order: 1) a first phase construction to end the discharge of raw sewage to recreational waters by 1954 and 2) to treat all of the sewage and other polluting wastes from New York City by December 31, 1959. In November 1954, New York City submitted a time schedule for the second phase of the program, requesting an extension of time for completion from 1959 to 1964. The Commission issued a new order in 1957 fixing a progress schedule and extending the time for completion of the entire New York City program from 1959 to December 31, 1967. At present it appears that the 1967 deadline will not be met. Completion will be more than 20 years after the original consent order was promulgated.

A major source of pollution in the New York Harbor area is the discharge of primary treated sewage from the Passaic Valley Sewage Treatment Plant. The Tri-State Compact specifically removes this plant from the jurisdiction of the Interstate Sanitation Commission provided the following conditions are met:

(1) There will be absence in the New York Bay of visible suspended particles coming from the Passaic Valley sewage.

(2) There will be absence of deposits objectionable to the Secretary of War of the United States in the New York Bay coming from the Passaic Valley sewage.

(3) There will be absence in the New York Bay and its vicinity of odors due to the putrefaction of organic matters contained in the Passaic Valley sewage thus discharged.

(4) There will be a practical absence on the surface of New York Bay of any grease or color due to the discharge of the Passaic Valley sewage at the dispersion area or elsewhere.

(5) There will be no injury to the public health which will be occasioned by the discharge from the said sewer into the Bay of New York in the manner proposed and no public or private nuisance will be created thereby.

(6) The absence of injurious effect from said sewage discharge, upon the property of the United States situated in the Harbor of New York.

(7) The absence of reduction in the dissolved oxygen contents of the waters of New York Bay, resulting from the discharge of Passaic Valley sewage, to such an extent as to interfere with major fish life.

From 1948 to 1956 the Passaic Valley Sewage Treatment Plant was exempt from the enforcement provisions of the Federal Water Pollution Control Act. It is believed, however, that at present the New Jersey State Health Department, the Interstate Sanitation Commission through the above noted conditions of permit, and the Federal Government have sufficient jurisdiction to deal with the discharge from this plant.

Page 21: Under "Status of Programs", 3rd paragraph from bottom. Add after last sentence of paragraph the following:

Additionally, New York State recently inaugurated a new comprehensive pollution control program which includes fiscal incentives for planning construction and operation of sewage treatment works. The keystone of this program is the billion dollar bond issue to be presented to the electorate in November. Coupled with this is an enforcement program under which in September 1965, the New York State Health Department initiated ~~legal~~ action against six municipalities with a combined population of about 250,000 and five industries discharging to this section of the Hudson River.

SOURCES OF WASTE

Municipal

The total oxygen demanding load discharged to the Hudson from all municipal sources is estimated to be equivalent to the waste from 10,000,000 people. In the area considered, from Troy to the Narrows, there are 48 discharges of municipal wastes directly to the main stream of the river. In addition there are 26 discharges to tributaries throughout the entire length which directly affect the main stream. Six municipal discharges receive secondary treatment with a resultant effluent strength of 1,959,000 population equivalents. Forty-four discharges received primary treatment and the resulting effluent contributes 3,760,000 population equivalents to the stream. Raw sewage discharges having a population equivalent of 4,297,000 are added by 24 communities. A summary of these discharges is outlined in Table 6.

In the upper Hudson from Troy south to the Ulster County Line, the majority of wastes are discharged as raw sewage, or with inadequate treatment as in the case of Albany. The P. E. discharged in the Albany-Troy-Rensselaer area alone amounts to 250,000. Although most of the loadings on the Hudson system in the mid-river area, from approximately Kingston to Bear Mountain, receive primary treatment, the total P.E. to the River amounts to 143,000. In the more urbanized area of Westchester and Rockland Counties, where the majority of the sewage receives primary treatment, the total discharges to the stream amount to 353,000 P.E. In the lower section of the river, in the New York City area, there are large concentrations of untreated and treated municipal wastes. Figures 2aand 2b indicate the location of the various discharges to the lower section.

One activated sludge plant, at Owls Head, discharges to the Upper Bay. Pollutional discharges to the Hudson from the New York City line to the Narrows amount to 5,091,000 P.E. Because of the tidal nature of New York Harbor, wastes from the East River, the Harlem River, the Kill Van Kull, and Newark Bay, enter the lower Hudson and Upper Bay and increase its pollutional loading. 487,000 population equivalents come from the Newark Bay-Van Kull area, and 3,693,000 population equivalents are contributed from the East River and Harlem River areas. A section of the Bronx, bordering the Hudson River, more than two thirds of the Borough of Manhattan, and large portions of the areas of Brooklyn and Staten Island, and a smaller portion of the Borough of Queens, tributary to the Hudson River system, are presently discharging raw sewage amounting to 3,920,000 P.E.

COHOES
TROY
WATERVLIET
ALBANY
RENSSELAER
E. GREENBUSH
COXSACKIE
ATHENS
CATSKILL
HUDSON
KINGSTON
POUGHKEEPSIE
NEWBURGH
BEACON
HIGHLAND FALLS
PEEKSKILL
W. HAVERSTRAW
CROTON ON HUDSON
HAVERSTRAW
OSSINING
NYACK
N. TARRYTOWN
S. NYACK
TARRYTOWN
ORANGETOWN
IRVINGTON
PEARL RIVER
YONKERS
LEGEND
NO TREATMENT
PRIMARY TREATMENT
SECONDARY TREATMENT
0 5 10 15
MILES

FIGURE 2a

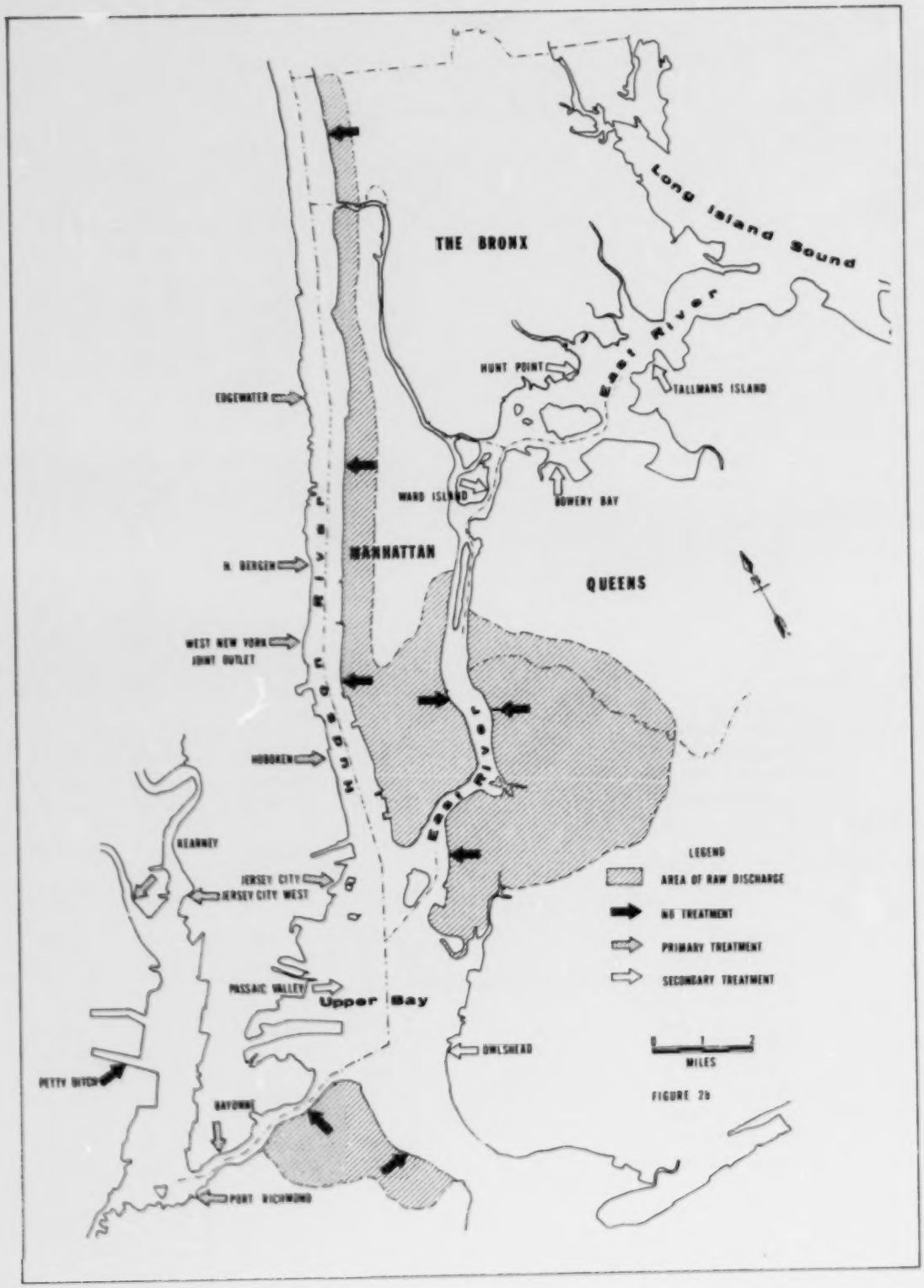

THE BRONX
Long Island Sound
East River
HUNT POINT
TALLMANS ISLAND
EDGEWATER
WARD ISLAND
BOWERY BAY
MANHATTAN
N. BERGEN
QUEENS
WEST NEW YORK
JOINT OUTLET
Hudson River
HOBOKEN
East River
KEARNEY
JERSEY CITY
JERSEY CITY WEST
PASSAIC VALLEY
Upper Bay
OWLSHEAD
PETTY DITCH
BAYONNE
PORT RICHMOND
LEGEND
AREA OF RAW DISCHARGE
NO TREATMENT
PRIMARY TREATMENT
SECONDARY TREATMENT
0 1 2
MILES

FIGURE 2b

Table 6

Municipal Waste Discharges to the Hudson River and Its Tributaries

River Miles No. Of Battery	Municipality	Population Tributary To Stream	Treatment	Estimated Flow MGD	Pop. Equiv.
151	Cohoes	20,129	None	2.00	20,130
151	Green Island	3,533	None	0.35	3,530
150	Troy	67,492	None	6.75	67,490
149	Watervliet	14,000	None	1.40	14,000
148	Menands	2,314	None	0.25	2,310
141	Albany	126,000	Primary	12.60	126,000
Tributary-	Patroons Creek				
	West Albany	550	None	.06	550
Tributary-	Unnamed				
	Colonie-Latham	2,600	Primary	.26	1,800
141	Rensselaer	10,506	None	1.05	10,500
139	East Greenbush	5,200	Primary	.52	3,600
135	Castleton-on-Hudson	1,752	None	.18	1,750
Tributary-	Coeymans Creek				
	Ravena	2,424	Primary	.24	1,600
	Coeymans	854	None	.09	850
122	Coxsackie	2,849	None	.28	2,850
116	Athens	1,754	None	.18	1,750
116	Hudson	11,075	None	1.11	11,075
110	Catskill	5,825	None	.58	5,825
104	Cementon	700	None	.07	700
Tributary-	Esopus Creek				
	Saugerties EBP	800	Primary	.08	550
	Saugerties DUP	1,600	Primary	.16	1,100
	Saugerties PP	1,500	Primary	.15	1,050
Tributary-	Stoney Creek				
	Tivoli	750	Primary	.08	525
Tributary-	Roundout Creek				
	Kingston	29,000	Primary	2.90	20,300
Tributary-	Twaalskill				
	Highland	3,000	Primary	.30	2,100
74	Poughkeepsie	38,330	Primary	3.83	26,830
74	Arlington Sewer Dist.-Poughkeepsie	6,155	Primary	.62	4,300
Tributary-	Wappinger Creek				
	Wappinger Falls	3,500	Primary	.35	2,450
60	Newburgh	32,000	None	3.20	32,000
60	Beacon	17,500	Primary	1.75	12,250
57	Cornwall	2,000	Primary	.20	1,400
Tributary-	Moodna Creek				
	New Windsor	6,250	Primary	.63	4,375
	Cornwall SD #1	2,500	Primary	.25	1,750

Table 6

Municipal Waste Discharges to the Hudson River

and Its Tributaries (Cont'd)

River Miles No. of Battery	Municipality	Population Tributary To Stream	Treatment	Estimated Flow MGD	Pop. Equiv.
54	Cold Spring	2,083	None	.21	2,080
50	Highland Falls	4,470	Primary	.45	3,130
43	Peekskill	18,700	Primary	1.70	12,000
Tributary -	Minisceongo Creek				
	West Haverstraw	5,000	Primary	.80	8,800
36	Haverstraw	5,800	Primary	.40	4,200
36	Croton-on-Hudson	3,920	Primary	.40	3,800
32	Ossining - Liberty St.	1,600	Primary	.30	1,100
	Ossining - Water St.	15,000	Primary	1.10	10,480
31	Briarcliff Manor	1,700	Primary	.20	1,200
	North Tarrytown	8,800	Primary	1.20	8,700
29	Upper Nyack	1,000	Primary	.10	500
28	Nyack	6,000	Primary	.80	10,000
28	Tarrytown	11,100	Primary	1.30	9,700
27	South Nyack	3,100	Primary	.30	2,400
25	Piermont	1,800	Primary	.20	1,700
25	Sewer Dist. #3 (Pearl River)	3,600	Secondary	1.90	10,700
25	Sewer Dist. #2 (Orange Town)	2,500	Primary	.50	1,800
24	Irvington	5,500	Primary	.70	4,600
16	Yonkers	440,000	Primary	61.00	261,500
14	Bronx-Riverdale	30,000	None	3.00	30,000
Tributary -	Harlem-Upper East River				
	Northern Manhattan	40,000	None	6.00	40,000
	Manhattan-Wards Island	1,470,000	Secondary	215.00	418,100
	Bronx-Hunts Point	770,000	Secondary	130.00	473,700
	Queens-Bowery Bay	750,000	Secondary	100.00	340,300
	Queens-Tallmans Island	251,000	Secondary	38.00	221,000
9	Edgewater, N. J.	21,700	Primary	1.70	15,500
8	Manhattan (West Side)	671,000	None	230.00	1,500,000*
7	North Bergen	14,700	Primary	.70	4,600
5	West New York	50,000	Primary	6.70	79,000
2	Hoboken	70,000	Primary	8.80	81,200
Tributary	Lower East River) Manhattan (East Side)) Brooklyn)	2,200,000	None	310.00	2,200,000*

*Includes transient working population.

Table 6

Municipal Waste Discharges to the Hudson River

and Its Tributaries (Cont'd)

River Miles No. of Battery	Municipality	Population Tributary To Stream	Treatment	Estimated Flow MGD	Pop. Equiv.
	Jersey City-East	180,000	Primary	31.70	230,200
	Passaic Valley	1,150,000	Primary	230.00	2,500,000
	Red Hook	130,000	None	20.00	130,000
Tributary-	Kill Van Kull-Newark Bay				
	St. George-West	25,000	None	2.50	25,000
	Port Richmond	60,000	Primary	6.70	55,200
	Bayonne	75,000	Primary	6.70	58,600
	Newark Bay-Petty Ditch	170,000	None	30.00	170,000
	Jersey City-West	120,000	Primary	12.00	170,600
	Kearney	117,000	Primary	2.20	8,000
	Staten Island-St. George-East	25,000	None	2.50	25,000
	Brooklyn-Owls Head	750,000	Secondary	98.00	495,000

Estimates of flow and population equivalents for discharges north of the Bear Mountain Bridge were from New York State Health Department Listings. For areas below Bear Mountain Bridge, data from the Interstate Sanitation Commission was used.

33% of the population equivalents discharged to the Hudson River are from the waste discharges in New Jersey; the remaining 67% results from discharges from New York. The major source of waste from New Jersey is the Passaic Valley Sewerage Commission outfall located at Robbins Reef in the Upper Bay. This source discharges approximately 2,500,000 population equivalents. An additional major source of waste is the discharge of raw sewage from the Petty Ditch into Newark Bay. The Petty Ditch discharges approximately 170,000 population equivalents of raw sewage from a section of Newark. Construction is currently under way on an intercepting sewer which will divert the waste from the Petty Ditch area to the Passaic Valley Sewage Treatment Plant. Construction is also under way on interceptors in the lower half of Manhattan and a major treatment facility at Newtown Creek in Brooklyn which will service the intercepted area. The Newtown Creek facility is expected to be in operation in 1967. Sewage is presently being discharged untreated.

Public Health Service grants for construction of sewage facilities in the area under consideration are summarized in Table 7.

787-603 O-65—3

Table 7

Public Health Service Grants for Construction of Sewage Treatment Facilities
For Communities South of Albany, N. Y. that discharge to
the Hudson River

Project Name	Number	Date of Offer	Type*	Total Cost	Eligible Cost	Grant	Status
New Jersey							
North Bergen	WPC-NJ-14	12/30/57	Primary STP	$855,000	$855,000	$250,000	Completed June 63
Guttenberg	WPC-NJ-32	11/6/61	Intercepting Sewer (Treatment at No. Bergen Plant)	83,200	83,200	24,469	Construction started 6/16/65
Weehauken-Union City	WPC-NJ-69	2/12/63	Intercepting Sewer (Primary treatment at Hoboken STP)	543,000	543,000	110,700	Completed 1964
New York							
Bethlehem	WPC-NY-3	2/27/57	Primary STP	260,600	260,600	70,660	Completed 1/13/59
East Greenbush	WPC-NY-29	5/20/57	Additions to Primary STP	52,144	52,144	15,643	Completed 4/2/58
Greenport	WPC-NY-38	9/13/57	Primary STP	204,900	204,900	70,566	Completed 1/7/60

* STP - Sewage Treatment Plant

Table 7

Public Health Service Grants for Construction of Sewage Treatment Facilities for Communities South of Albany, N. Y. that discharge to the Hudson River (Cont'd)

Project Name	Number	Date of Offer	Type*	Total Cost	Eligible Cost	Grant	Status
New York (Cont'd)							
Hudson	WPC-NY-258	4/20/65	Primary STP	868,400	851,700	255,510	Not yet advertised for bids
Poughkeepsie, Arlington Sewer District	WPC-NY-11	3/12/57	Primary STP	762,700	762,700	228,814	Completed 11/5/59
Poughkeepsie	WPC-NY-22	3/21/57	Primary STP	1,425,000	1,425,000	250,000	Completed 10/17/59
Wappingers Falls	WPC-NY-46	12/13/57	Primary STP (Effluent discharged to Wappingers Creek, 1-1/3 miles from Hudson River)	154,676	154,676	46,402	Completed 6/10/60
City of Beacon	WPC-NY-75	4/16/59	Primary STP	1,126,300	1,126,300	250,000	Completed 1962
City of Beacon	WPC-NY-148	12/19/61	Intercepting Sewer (Discharge to STP built under NY-75	350,000	339,800	101,940	Completed 10/64

*STP - Sewage Treatment Plant

Table 7

Public Health Service Grants for Construction of Sewage Treatment Facilities for Communities South of Albany, N. Y. that discharge to the Hudson River (Cont'd)

Project Name	Number	Date of Offer	Type*	Total Cost	Eligible Cost	Grant	Status
New York (Cont'd)							
Highland Falls	WPC-NY-47	9/11/59	Primary STP and additions to an existing Primary Plant	182,134	182,134	54,640	Completed 11/14/62
Newburgh	WPC-NY-53	8/17/59	Primary STP	2,760,000	1,276,800	250,000	Authorized to Advertise 6/5/63 No Bids Taken as Yet
New Windsor	WPC-NY-146	11/22/61	Additions to a Primary STP	125,000	97,850	29,355	Completed 11/30/64
Village of Cold Srpings	WPC-NY-244	11/19/64	Primary STP	519,830	481,000	144,300	Authority to Advertise 6/15/65
Orangetown	WPC-NY-69	9/26/58	Primary STP	535,850	535,850	160,755	Completed 4/12/61

* STP - Sewage Treatment Plant

Table 7

Public Health Service Grants For Construction of Sewage Treatment Facilities for Communities South of Albany, N. Y. that Discharge to the Hudson River (Cont'd)

Project Name	Number	Date of Offer	Type*	Total Cost	Eligible Cost	Grant	Status
New York (Cont'd)							
Orangetown	WPC-NY-176	12/19/62	Interceptors and Pumping Stations Treatment (Primary) at STP built under NY-69 and at another primary STP at Pearl River	1,871,800	612,700	183,810	85% Complete 11/64
Piermont	WPC-NY-9	5/7/58	Pumping station, Force main, and Interceptor (treatment to be at Orangetown Plant)	451,031	357,900	107,370	50% Complete 8/65
Nyack	WPC-NY-160	2/23/62	Alterations to existing primary STP	19,140	19,140	5,741	Complete 5/18/62
Town of Lloyd	WPC-NY-112	10/25/60	Alterations to existing Primary STP	130,500	127,515	38,254	Completed 8/1/64

*STP - Sewage Treatment Plant

Table 7

Public Health Service Grants For Construction of Sewage Treatment Facilities for Communities South of Albany, N. Y. that Discharge to the Hudson River -(Cont'd)

Project Name	Number	Date of Offer	Type*	Total Cost	Eligible Cost	Grant	Status
New York (Cont'd)							
Kingston	WPC-NY-121	7/3/61	Interceptor and additions to existing primary STP	282,300	282,300	84,690	Completed 6/1/65
Yonkers (Westchester County)	WPC-NY-50	9/16/58	Primary STP	10,500	4,840	250,000	Completed 8/60
Peekskill	WPC-NY-88	3/24/60	Interceptor Sewer, Pumping station & Force Main (Primary treatment at existing STP	671,300	550,000	165,000	61% complete on 7/12/65
Buchanan	WPC-NY-155	1/18/62	Secondary STP	778,800	364,042	109,212	Completed 9/63
Buchanan	WPC-NY-247	4/15/65	Pumping Station, Force Main and Interceptor (Treatment at Buchanan STP)	187,500	175,500	52,650	Under Construction 4/19/65

*STP - Sewage Treatment Plant

Industrial Waste Discharges

The listing of waste discharges to the Hudson, prepared by the New York State Health Department, indicated that there are at least 53 known discharges of industrial wastes to the Hudson River or its immediate tributaries. A list of industrial waste discharges in New Jersey is not available from the official water pollution control agencies concerned to the best knowledge of the Federal investigators. Similarly, specific information on volume and strength of industrial wastes in both New York and New Jersey discharged to the Hudson River or its tributaries was not available. In the Albany area there is a concentration of paper manufacturing plants and meat packing houses. Both of these industry groups are normally known to contribute large organic loadings to the stream. Table 8 summarizes the information provided by the New York State Health Department. It indicates that industry is equally distributed down the length of the stream and the sizes of the industries, in many cases, are significant as can be noted from the number of employees shown in Table 8. The contributions from these industries to the water pollution problems of the Hudson are indicated in the summary of the waste characteristics.

Industries located on the tributaries in many cases cause problems on the main stream of the Hudson. Industrial wastes in the Moodna Creek area have been brought to the attention of the Public Health Service on several occasions, as creating a public nuisance.

Table 8

Industries Discharging Wastes to the Hudson River

River Miles	Company	Employees	Waste Characteristics
151-133	ALBANY COUNTY		
	Manning Paper	800	Paper wastes (fiber, color, organic solids)
	Alleghany-Ludlum Corp.	1750	Oil and Discoloration
	Delaware & Hudson	--	Oil
	Tobin Packing Co.	1050	Meat processing (organic, color, solids)
	Mohawk Paper Co.	375	Solids, fiber, discoloration
	Carr Packing Co.	90	Blood and washings
	Behr-Manning	1750	Acids and Organics
151-133	RENSSELAER COUNTY		
	F.C. Huyck & Sons	400	Felt and fabrics (fiber, colors, solids)
	Fort Orange Paper Co.	400	Paper wastes (fibers, colors, organic, solids, chemicals)
	Loeffel Waste Oil Co.	--	Oil sludge
	Ludlow Valve Co.	250	Metal processing (acids, alkalies, solids)
	Winthrop-Stearns Corp.	1350	Drug manufacturing (chemicals, colors, solids)
	General Analine & Film	800	Dye wastes (solids, color, chemicals)
	Wood-Flong Corp	--	Paper wastes (fibers, colors, organic, solids, chemicals)
	Cuett-Peabody & Co.	1220	
133-101	COLUMBIA COUNTY		
	Columbia Corp.	190	Paper wastes (color, solids, organic)
	Prince-High Rock Mills	--	BOD and discoloration
	Clermont Fruit Packers	--	Solids and discoloration
	Northeast Fruit Growers Corp.	--	Solids and odors
101-76	DUTCHESS COUNTY		
	Texaco Research Center	1100	Discoloration from petroleum wastes
	Orchard Hill Farms	--	Septic system overflow
	DeLaval Separator	850	No present problem
	Western Lithograph Co.	1000	Present sewage system needs updating

Table 8

Industries Discharging Wastes to the Hudson River (Cont'd)

River Miles	Company	Employees	Waste Characteristics
101-76	ULSTER COUNTY		
	Roundout Paper Mills	84	Color, solids, turbidity
	Martin Contine Coated Paper Co.	--	Color from dye and finishing wastes
	Ulster County Tissue Mills	--	Color from dye and finishing wastes
	Dal Vechia & Sons	15	Solids from food processing
	Hudson Valley Apple Prod.	45	Solids and spent caustic solutions
	Hudson Valley Wine Co.	14	Volatiles from evaporators
76-43	ORANGE COUNTY		
	Ferndale Farms	--	Milky discoloration
	Mack Brothers	--	Waste treatment system failing
	Monroe Laundry	--	Greyish Discoloration
	Majestic Weaving	--	Fabric process and dye wastes
	Am. Felt. Co.	425	Color from fabric processing and sewage
	National Gypsum Co.	65	Discoloration and turbidity from processing
43-21	ROCKLAND COUNTY		
	Continental Can Co., Inc.	1150	White water and equipment wash-up
	Kay-Fries Chemicals, Inc.	225	Dark gray discoloration
	Elk Piece Dye Corks, Inc.	150	Dye wastes
	United Wire Goods	75	Plating rinse waters) Receiving
	E&S Finishing Co.	78	Dye rinsing) stream
	Piermont Finishing Co.	--	Dye rinsing) blue
	Head Textile Printers	--	Dye rinsing) discolor) ation
	New York Trap Rock Corp.	457	Orange discoloration and turbidity
43-12	WESTCHESTER COUNTY		
	Refined Syrups & Sugars, Inc.	600	Turbidity, color, sludge from sewage and wastes
	Chev. Div. of General Motors, Inc.	4000	Color and oil from metal washing and paint spraying
	Hudson Wire Co.	118	Plating and pickling wastes
	Barlow Chemical Corp.	--	Process wastes from production of synthetic chemicals
	New York Central RR Co.	--	Oil filter cleaning and shop wastes

Table 8

Industries Discharging Wastes to the Hudson River (Cont'd)

River Miles	Company	Employees	Waste Characteristics
	WESTCHESTER COUNTY (Cont'd)		
	Standard Coated Products	200	Turbidity, color and sludge from sewage and wastes
	Standard Brands, Inc.	425	Color from yeast fermentation and vinegar
	Cortland Stone Co.	--	Turbidity from dust control
	The Ednalite Optical Co.	68	Turbidity and oil from grinding processes
	Anaconda Wire & Cable Corp.	5300	-
	Fords Steel Products Corp.	38	-

Federal Installations

The Federal installations discharging wastes to surface water within the discussion area are shown in Table 9. In some cases the discharge is from an installation providing treatment of a portion of the total waste generated. Federal installations that discharge to municipally owned and operated sewerage systems have not been listed in this report; however, they do represent the major method of discharge in the conference area. Treatment of a Federal waste discharged to a municipally-operated sewerage system becomes the direct responsibility of the municipality through governing local and state health agencies. In the table several installations discharging both direct to the surface waters and to the city sewers are listed.

Present plans call for the connection of the Staten Island Marine Hospital and the Governor's Island installations to municipal sewer systems. Plans are presently being processed for a treatment plant for the industrial waste from Watervliet Arsenal. The installations at St. George, the Brooklyn Naval Shipyard, and Brooklyn Army Terminal are being deactivated. In summary, there are 15 Federal installations discharging 6.3 mgd without treatment and there are 8 installations discharging 1.2 mgd with treatment. Two installations discharge 300,000 gpd to city sewers. The total discharge from Federal installations is 8 mgd or less than 1% of the total waste discharge to the Hudson River.

Institutions

There are a number of public institutions located along the banks of the Hudson River, many of which discharge their wastes to the stream. There are numerous units ranging in size up to establishments such as Letchworth Village and Sing-Sing Prison. The discharges from institutions normally closely approximate the discharge from municipalities in composition and pollutional effect.

Storm Water Overflow

Many of the sewerage systems in the Hudson River Valley are composed of combined sewers. Historically, the generally accepted engineering practice in this country has been to design combined sewers to handle storms two to three times the dry weather flow. When the flow exceeds this, a combination of sewage and storm water is by-passed directly to the receiving water. This phenomenon which occurs as often as once a week during the summer months when normal rainfall patterns exist, results in substantial organic loadings being discharged to the stream. In the Upper East River area, there are more than 60 combined outlets

Table 9

FEDERAL INSTALLATIONS DISCHARGING TO SURFACE WATERS WITHIN THE CONFERENCE AREA

INSTALLATION	AGENCY	EST. VOLUME GPD SANITARY	EST. VOLUME GPD INDUSTRIAL	TREATMENT	STREAM
Troy Lock & Dam	CofE	260		None	Hudson
St George Base	C.G.	80,000		None	N.Y. Harbor
Robbins Reef Lt. Sta.	C.G.	120		None	N.Y. Harbor
S.I. Marine Hosp.	PHS	177,000		City Sewer	
			19,000	None	N.Y. Harbor
Hudson Reserve Fleet	Maritime Ad.	2,500		None	Hudson
Naval Shipyard-Bklyn	Navy	750,000		None	East
			4,700,000	None	East
Medical Supply Agency	GSA	80,000		None	N.Y. Harbor
Bklyn Army Terminal	Army	348,000		Sewer	
		112,000		None	N.Y. Harbor
Governors Island	Army	357,000		None	N.Y. Harbor
Statue of Liberty	N.P.S.	10,000		Primary	N.Y. Harbor
Governors Isl. Light	C.G.	100		None	N.Y. Harbor
U.S. Military Academy	Army	758,000		Primary	Hudson
Training Camps	Army	94,000		Primary	Popolopen Crk.
Golf Clubhouse	Army	1,300		Primary	Highland Br.
Qtrs 148,394,609	Army	800		None	Hudson
U.S. Storehouse-Albany	CofE	100		None	Patroon Crk.
Watervliet Arsenal	Army	102,400		City Sewer	
			248,000	None	Hudson
No. Brother Isl. Lt. Sta.	C.G.	100		None	East
Throggs Neck Lt. Sta.	C.G.	100		Primary	East
VA Hosp - Castle Pt.	V.A.	81,000		Primary	Hudson
VA Hosp - Montrose	V.A.	166,000		Primary	Hudson
Bayonne Supply Depot	Navy	70,000		Primary	N.Y. Harbor

Table 10

INSTITUTIONS DISCHARGING WASTES TO THE HUDSON RIVER AND ITS TRIBUTARIES

INSTITUTIONS	POPULATION TRIBUTARY TO STREAM	TREATMENT	DISCHARGES FLOW MGD	ESTIMATED P E
N.Y. State Hosp. - Poughkeepsie	6,000	Primary	0.60	4,200
N.Y. State Hosp. - Matteawan	3,000	Primary	0.30	2,100
N.Y. State Hospital - Rockland	500	Primary	0.05	350
Letchworth Village	4,000	Primary	0.40	2,800
Palisades Interstate Park	5,000	Primary	0.10	3,500
Sing Sing State Prison	3,000	Primary	0.30	2,100
St. Joseph's Home	500	None	0.05	500
N.Y. Military and Naval Affairs	2,400	Primary	0.24	1,680

serving the Bronx and Queens. This area is completely sewered to modern sewage treatment plants providing secondary treatment. The effect of the storm water overflows is to undo the extensive treatment and subsequent removal of waste materials that the sewage treatment plants were constructed to accomplish. Combined sewers exist in many other areas of the Hudson River system. Loadings from these sewers are not available.

EFFECTS OF POLLUTION ON WATER QUALITY AND USES

Introduction

Sewage and many industrial wastes contain organic matter that decomposes and exerts a demand on the oxygen dissolved in the receiving waters. In the process of degradation, the dissolved oxygen is reduced below its normal level in satisfying the demand of the decomposing organic material. High concentrations of decomposable material will cause a sharp reduction of the oxygen in the stream with a resulting reduction or elimination of desirable aquatic life including fish. Wastes strong enough to completely deplete the dissolved oxygen will cause offensive odors. Dissolved oxygen, therefore, is universally regarded as one of the criteria for judging water quality.

A generally accepted requirement throughout the country for maintenance of a good quality water for protection of aquatic life and other uses is five milligrams of oxygen dissolved in each liter (mg/l). A liter is approximately one quart of water. Because of the tidal characteristics and mixing of the waters within the conference area, a lower quality of water in one section has a direct effect on other areas including those with a higher quality water.

Municipal waste effluents contain enormous numbers of intestinal bacteria, among which there are usually pathogenic organisms that cause gastro-intestinal diseases such as diarrhea and typhoid fever. Pathogenic bacteria can cause illness in persons who contact or ingest waters containing them. Effective waste treatment and disinfection can reduce or eliminate the density of pathogenic bacteria and the resulting hazard of contracting diseases from waste discharges.

Bacteria of the coliform group typically occur in excreta or feces and can readily be detected. Coliform bacteria, usually harmless in themselves, are always present in river water receiving municipal wastes and have been used as an indication of the probable presence of pathogenic organisms. The possibility of pathogens being present in the absence of coliform organisms is extremely remote. The coliform group has been used by numerous state and interstate pollution control agencies as a basis for water quality objectives for various water uses. For recreational waters, where body contact is present, e.g. swimming or water skiing, it has been the practice of most state water pollution control agencies to subscribe to a requirement not to exceed a mean value of coliform density of 1,000 organisms in 100 milliliters, or about four ounces of water (1000/100 ml). Because of the intermixing through tidal currents between recreational and non-recreational waters, waste discharges affect areas other than that to

which they are discharged. In no instance should discharges to non-contact recreational waters be of such quality as to adversely affect waters of higher use.

Unpolluted water supports a diverse population of bottom organisms and fish. Two major changes may occur in the biological populations of rivers as the result of the discharge of wastes: (1) there will be an increase in the number of pollution tolerant organisms with a corresponding decrease in the numbers and species of clean water indicator organisms; (2) the discharge of wastes may be so great or may be of a toxic nature such that all bottom dwelling organisms are destroyed, leaving a complete absence of biological life. Biological evaluations are a valid indicator of the degree of water pollution.

Effects of Pollution

Water quality in the Hudson River system is the result of the numerous discharges of untreated and inadequately treated wastes from municipalities and industries from the Federal Dam and Lock at Troy to the Narrows.

Dissolved Oxygen

On the basis of the criteria of dissolved oxygen content, the river, during a survey this August, demonstrated the impact of the wastes discharged to it (Figure 3). For a distance of some 60 miles downstream from the Albany-Troy-Rensselaer area, depressed oxygen conditions existed. For 20 miles, from Albany downstream, the river was essentially devoid of dissolved oxygen.

The river never returned to a state of relatively complete oxygen saturation until it reached the ocean in the New York Bight. This was the result of additional waste discharges downstream which were sufficient to prevent full recovery. The maximum levels reached during the August survey were 7 mg/l in the vicinity of the Tappan Zee Bridge. At this point the effect of the discharges in the New York metropolitan area, carried by tidal currents, further depressed the oxygen levels to less than 4 mg/l. In the immediate City area, from the George Washington Bridge to the Narrows, dissolved oxygen levels of less than 4 mg/l generally prevailed. Previous surveys of October 1963 and July 1965 by the Public Health Service present similar patterns of oxygen content.

An examination of the extensive records maintained by the New York City Department of Public Works indicates that the levels of oxygen found in August of this year are not significantly different from those that have prevailed over the summers of the past ten years in this general area (Figure 4). Dissolved oxygen in the metropolitan area, because of the influx of sea water, shows considerable stratification, with much lower values recorded for the underlying waters of the

DISSOLVED OXYGEN—HUDSON RIVER

AUGUST 22—24, 1965

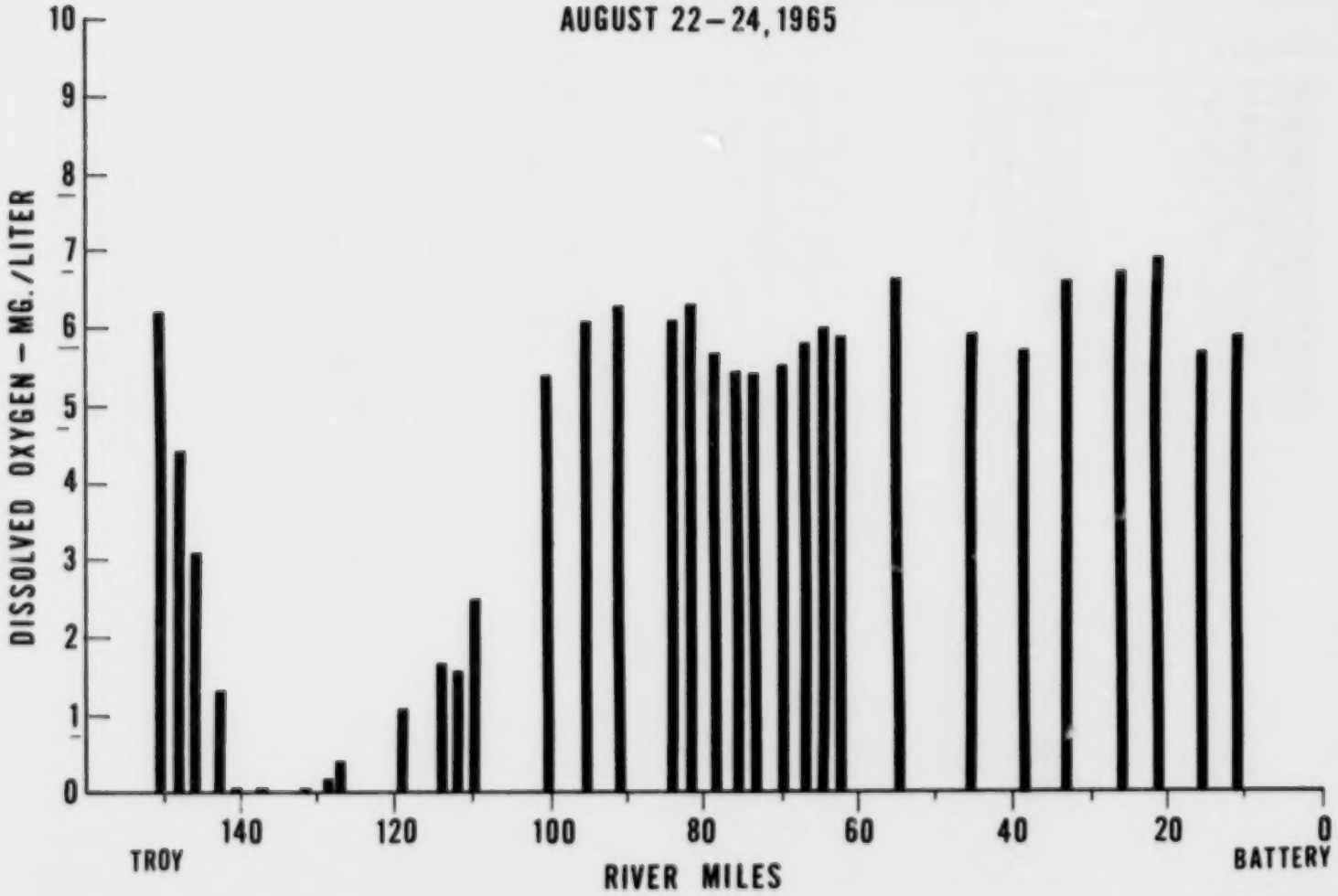
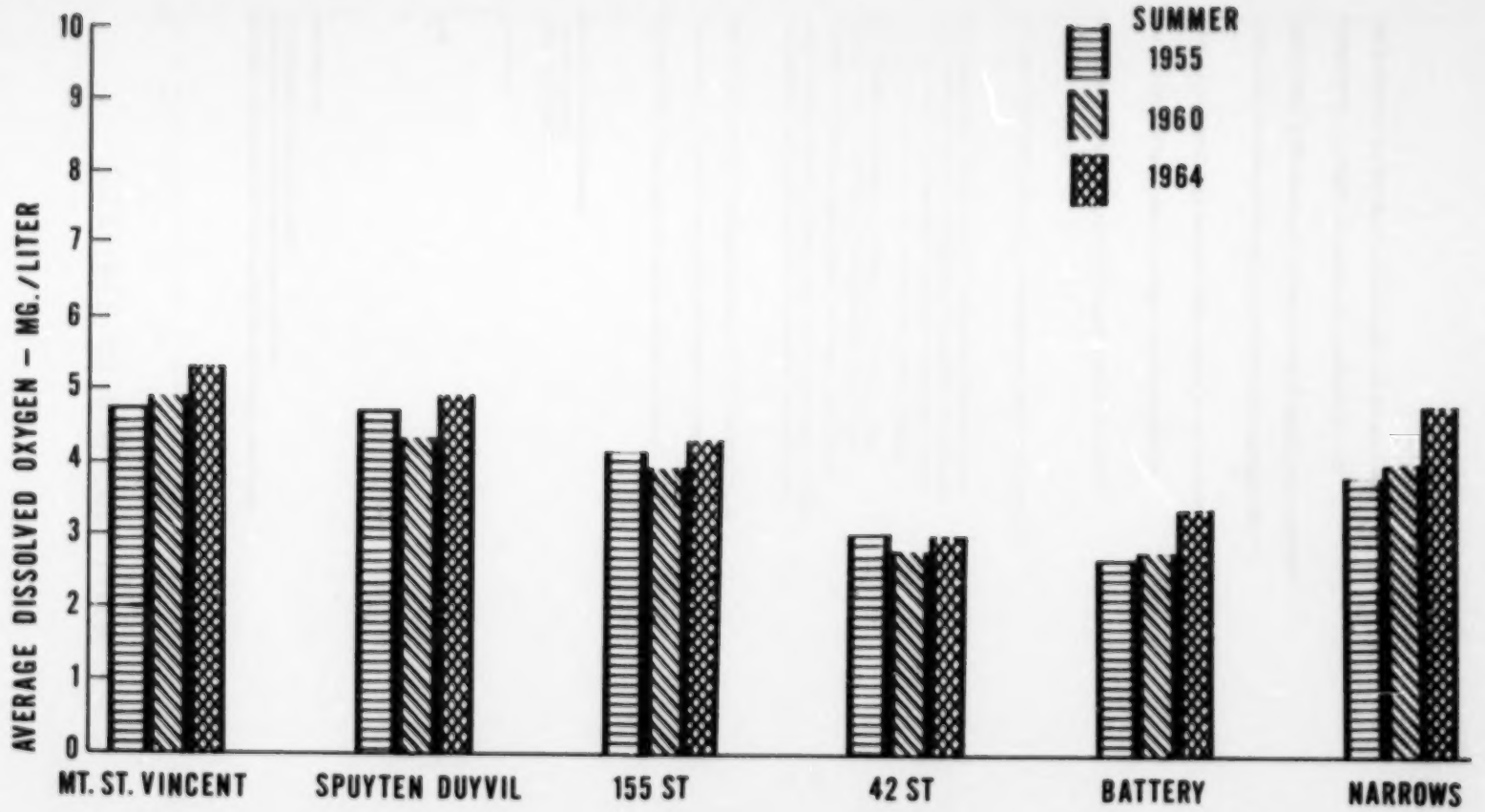


FIGURE 3

DISSOLVED OXYGEN—NEW YORK HARBOR



NYCDPW

FIGURE 4

area. Values of approximately 5 mg/l on the surface to 3 mg/l on the bottom were recorded in the Mount St. Vincent area at the New York City line. The low point in the Hudson River proper appears to exist in the area between the Battery and 42nd Street where surface values of approximately 3 mg/l were recorded and underlying water values of 2. to 2.5 mg/l have been recorded.

Dissolved oxygen in the Hudson River varies on the average from about 4.5 mg/l at the city line to about 3.0 mg/l at the Battery and recovers to about 4.0 mg/l at the Narrows. In general, mean values during warm weather periods are less than 4.0 mg/l throughout the entire section under consideration. The effect of the discharge at the Passaic Valley outfall was demonstrated by data collected by the Interstate Sanitation Commission in 1958. At that time, it became necessary for Passaic Valley to bypass their sewage without treatment for a period of time. During this time dissolved oxygen throughout the Bay was reduced about 1.3 mg/l with a low mean value of 2.3 mg/l resulting at the Battery.

Oxygen levels in the major tributary areas of New York Harbor similarly showed severely depressed conditions due to the large volume of urban wastes discharged to the system in this area.

The untreated wastes discharged into the lower East River from Manhattan Island below 72nd Street and from Brooklyn south of Newtown Creek have resulted in a foul smelling, unesthetic and thoroughly degraded waterway. The dissolved oxygen content from the Battery to Ward's Island is less than 3.0 mg/l with lower limits observed at less than 0.5 mg/l at Newtown Creek. When the proposed Newtown Creek treatment plant is placed into operation, the treated sewage will be discharged right at the present low point for dissolved oxygen just opposite the United Nations building.

Vast quantities of sludge deposits on the bottom of the river also contribute to the dissolved oxygen degradation and to the highly unsightly condition. The Lower East River is a long way from attaining 5.0 mg/l and, in fact, cannot even meet the Interstate Sanitation Commission standard of 30% saturation. During warm weather, 30% saturation equals a dissolved oxygen of about 2.2 mg/l. The Upper East River north of Ward's Island has been described by the State of New York as polluted throughout its entirety. Dissolved oxygen during the summer varies from about 0.7 mg/l near Ward's Island to about 2.5 to 3.0 mg/l at Throgs Neck, just before entry to Long Island Sound.

In the Harlem River area dissolved oxygen ranges from a high of 3.5 mg/l at Spuyten Duyvil, where the Harlem joins the Hudson, to 1.5 mg/l at the East River. Polluted waters from the Harlem River will penetrate to the Hudson River when the currents are flowing in a northerly direction.

Dissolved oxygen values in the Kill Van Kull have often been observed at values of less than 2 mg/l and in the main channel of Newark Bay at less than 2.5 mg/l. Newark Bay is, in effect, a vast holding pond with little net movement of the wastes discharged to it. These wastes exercise their biochemical oxygen demand in the immediate area of the discharge to such an extent as to make the conditions of these waters offensive. In instances when the Passaic Valley Treatment Plant was discharging to Newark Bay, values of dissolved oxygen approaching septicity were experienced throughout Newark Bay and the Kill Van Kull.

Coliforms

On the basis of criteria of coliform density, a pattern of high coliform counts, reflecting discharges of raw and inadequately treated municipal wastes were found in the August 1965 survey as shown in Figure 5. Peak values in excess of 50,000/100 ml were found in the immediate area of Albany-Troy-Rensselaer, with levels in excess of 1,000/100 ml extending as far south as Catskill, a distance of 40 miles. Coliform densities at the Rensselaer water intake exceeded 15,000/100 ml. Bacterial pollution discharged to the Hudson in the area causes a health hazard to persons who come in contact with the water for recreational or other purposes within the 40 mile area.

From Catskill to Tarrytown values of from 3,000 to 5,000/100 ml were recorded, exceeding the recommended 1,000/100 ml maximum for recreational waters. From Tarrytown to the New York City line, coliform densities increased in value to greater than 5,000/100 ml.

Data from the New York City Department of Public Works show that mean coliform densities for the past ten summers have been in excess of 10,000/100 ml throughout the Hudson from the George Washington Bridge to the Narrows (Figure 6). Mean values of 22,000/100 ml, upstream at Spuyten Duyvil in 1960, and 14,000/100 ml at Mount St. Vincent were also recorded. In the Robbins Reef area of New York Bay, values of 33,000/100 ml have been recorded. The average coliform density in the lower Hudson, between the Battery and the George Washington Bridge ranges between 6,000 and 40,000/100 ml, depending upon the tidal phase. Coliform densities are higher in the bottom waters than the surface waters and at all times coliform densities exceeded 5,000/100 ml.

The East River again showed the effect of severe pollution with concentration reportedly greater than 110,000/100 ml being reached. At Newtown Creek, samples have been isolated of coliform counts of greater than 2,000,000/100 ml. Coliform data gathered in the Rikers Island area indicate an average density of 30,000 to 50,000/100 ml

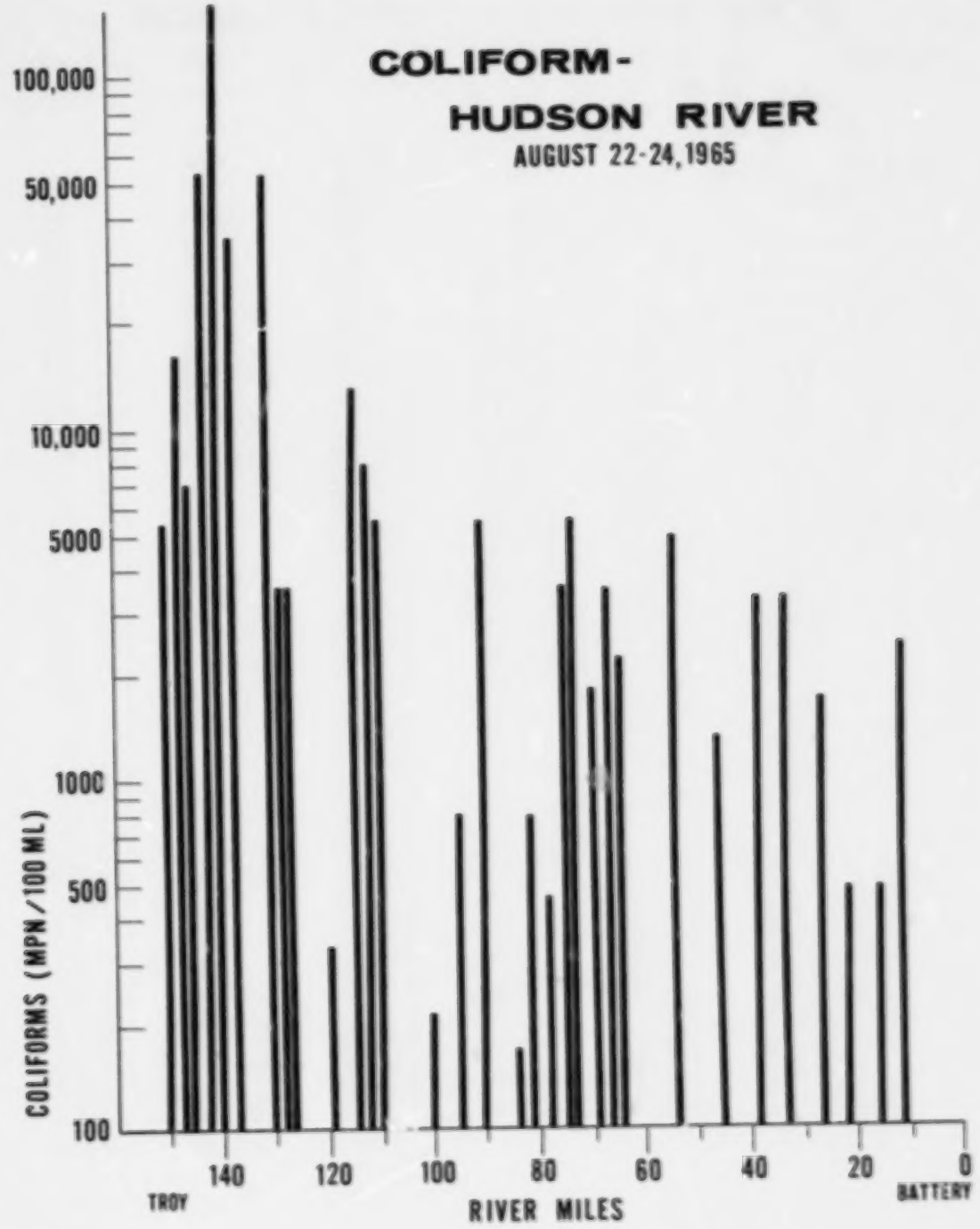

COLIFORM-
HUDSON RIVER
AUGUST 22-24, 1965
100,000
50,000
10,000
5000
1000
500
100
COLIFORMS (MPN/100 ML)
140
120
100
80
60
40
20
0
TROY
BATTERY
RIVER MILES

FIGURE 5

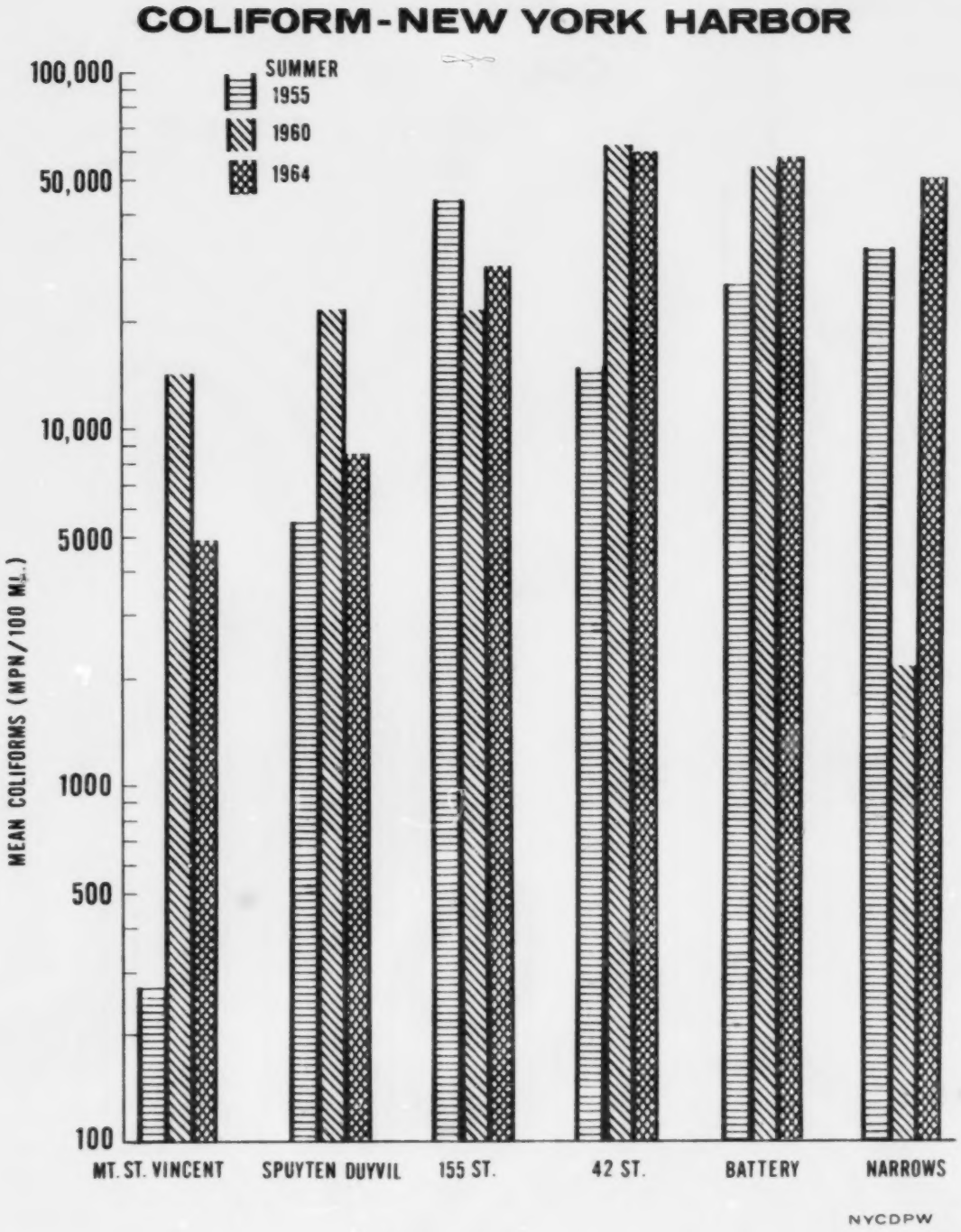

COLIFORM-NEW YORK HARBOR
SUMMER
1955
1960
1964
100,000
50,000
10,000
5000
1000
500
100
MEAN COLIFORMS (MPN/100 ML.)
MT. ST. VINCENT
SPUYTEN DUYVIL
155 ST.
42 ST.
BATTERY
NARROWS
NYCDPW

FIGURE 6

and as one moves further east means of 4,000 to 10,000/100 ml have been recorded at Throgs Neck. Flood waters from the lower East River bring pollution from that area to the upper East River and also effluents from Wards Island, Bowery Bay and Hunts Point, which receive no chlorination, reach the site of proposed beaches at Ferry Point Park and Little Bay. The coliform density in this area exceeds values of 1,000/100 ml at present. This area cannot be used for bathing because of sewage contamination from both treated and untreated wastes. During wet weather over-flows from the combined sewers systems increase the coliform densities by three to four times their dry weather value.

In the Harlem River coliform densities range from 22,000 to 60,000/100 ml at the East River to 10,000 to 35,000/100 ml at its juncture with the Hudson River. Coliform densities in the Harlem River become progressively higher at those stages of current where the highly polluted waters from the East River flow up and through the Harlem into the Hudson River.

In the Kill Van Kull and in the mouth of Newark Bay, coliform densities have been observed to exceed 20,000/100 ml regularly.

Biology

Biological study of the Hudson during August 1965 confirms the pollutional patterns discussed in the preceeding paragraphs. Pollution tolerant organisms were found in extensive sections of the river from the Federal Dam at Troy downstream to Newburgh. Even these forms were not present in the vicinity of Albany and for a distance of 20 miles downstream. Oil coated the bottom and floated on the surface. Decomposing sludge deposits on the bottom caused gas bubbles to break the surface imparting obnoxious odors. Silts from industrial plants - rock crushing - were found to blanket the bottom in several areas, eliminating bottom life.

In the New York Harbor area, extensive sludge blankets exist in the East River and in Newark Bay. Rising sludge is visible in the shallower areas.

Pollution Trends

The Public Health Service maintained cooperatively at Poughkeepsie, a Water Pollution Surveillance System station over the past seven years. The records of this station were reviewed to determine longer term trends. The report on this station appears in Appendix D. In summary, the report indicates significant pollution on the basis of coliform levels recorded.

APPENDIX A

NEW YORK STATE CLASSES AND QUALITY STANDARDS

APPLICABLE TO DESIGNATED WATERS

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APPENDIX A

CLASSIFICATIONS AND STANDARDS OF QUALITY AND PURITY

Adopted by New York Water Pollution Control Board

Pursuant to Article 6*, Public Health Law

ADOPTING ORDER

Pursuant to the authority contained in Article 6* of the Public Health Law, the Board having held public hearings as therein provided, hereby adopts the following classifications and standards of quality and purity for the waters of New York State:

I. GENERAL CLASSIFICATION-STANDARDS SYSTEM

1. Definitions

The several terms, words or phrases hereinafter mentioned shall be construed as follows:

a. *Best usage* of waters as specified for each class shall be those uses as determined by the Board in accordance with the considerations prescribed by Section 109** of the Public Health Law.

b. *Approved treatment* as applying to water supplies means treatment accepted as satisfactory by the authorities responsible for exercising supervision over the sanitary quality of water supplies.

c. *Source of water supply for drinking, culinary or food processing purposes* shall mean any source, either public or private, the waters from which are used for domestic consumption or used in connection with the processing of milk, beverages, foods or for other purposes which require finished water meeting U.S. Public Health Service Drinking Water Standards.

d. *Fishing* shall include the propagation of fish and other aquatic life.

e. *Agricultural* shall include use of waters for stock watering, irrigation and other farm purposes but not as source of water supply for drinking, culinary or food processing purposes.

f. *Tidal salt waters* shall mean all tidal waters which are so designated by the Board and which generally shall have a chloride ion content in excess of 250 parts per million.

2. Conditions Applying To All Classifications and Standards

a. In any case where the waters into which sewage, industrial wastes or other wastes effluents discharge are assigned a different classification than the waters into which such receiving waters flow, the standards applicable to the waters which receive such sewage or wastes effluents shall be supplemented by the following:

"The quality of any waters receiving sewage, industrial wastes or other wastes discharges shall be such that no impairment of the best usage of waters in any other class shall occur by reason of such sewage, industrial wastes or other wastes discharges."

b. Natural waters may on occasion have characteristics outside of the limits established by the standards. The standards adopted herein relate to the condition of waters as affected by the discharge of sewage, industrial wastes or other wastes.

* Now Article 12
** Now Section 1209

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3. Classes and Standards for Fresh Surface Waters

CLASS AA

Best usage of waters: Source of water supply for drinking, culinary or food processing purposes and any other usages.

Conditions related to best usage: The waters, if subjected to approved disinfection treatment, with additional treatment if necessary to remove naturally present impurities, meet or will meet U. S. Public Health Service Drinking Water Standards and are or will be considered safe and satisfactory for drinking water purposes.

Quality Standards For Class AA Waters

Items	*Specifications*
1. Floating solids; settleable solids; oil; sludge deposits; tastes or odor producing substances.	None attributable to sewage, industrial wastes or other wastes.
2. Sewage or wastes effluents.	None which are not effectively disinfected.
3. pH.	Range between 6.5 and 8.5.
4. Dissolved oxygen.	For trout waters, not less than 5.0 parts per million; for non-trout waters, not less than 4.0 parts per million.
5. Toxic wastes, deleterious substances, colored or other wastes or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable as a source of water supply for drinking, culinary or food processing purposes or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

NOTE NO. 1: In determining the safety or suitability of waters in this class for use as a source of water supply for drinking, culinary or food processing purposes after approved treatment, the Water Pollution Control Board will be guided by the standards specified in the latest edition of "Public Health Service Drinking Water Standards" published by the United States Public Health Service.

NOTE NO. 2: With reference to certain toxic substances as affecting fish life, the establishment of any single numerical standard for waters of New York State would be too restrictive. There are many waters, which because of poor buffering capacity and composition, will require special study to determine safe concentrations of toxic substances.

However, based on non-trout waters of approximately median alkalinity (80 p.p.m.) or above for the state, in which groups most of the waters near industrial areas in this state will fall, and without considering increased or decreased toxicity from possible combinations, the following may be considered as safe stream concentrations for certain substances to comply with the above standard for this type of water. Waters of lower alkalinity must be specially considered since the toxic effect of most pollutants will be greatly increased.

Ammonia or Ammonium compounds	Not greater than 2.0 parts per million (NH_3) at pH of 8.0 or above
Cyanide	Not greater than 0.1 part per million (CN)
Ferro-or Ferricyanide	Not greater than 0.4 parts per million ($Fe(CN)6$)
Copper	Not greater than 0.2 parts per million (Cu)
Zinc	Not greater than 0.3 parts per million (Zn)
Cadmium	Not greater than 0.3 parts per million (Cd)

CLASS A

Best usage of waters: Source of water supply for drinking, culinary or food processing purposes and any other usages.

Conditions related to best usage: The waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to reduce naturally present impurities, meet or will meet U. S. Public Health Service Drinking Water Standards and are or will be considered safe and satisfactory for drinking water purposes.

Quality Standards for Class A Waters

Items	*Specifications*
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. Sewage or waste effluents.	None which are not effectively disinfected.
3. Odor producing substances contained in sewage, industrial wastes or other wastes.	The waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto shall not have an increased threshold odor number greater than 8, due to such added wastes.
4. Phenolic compounds.	Not greater than 5 parts per billion (Phenol).
5. pH.	Range between 6.5 and 8.5.

6. Dissolved Oxygen	For trout waters, not less than 5.0 parts per million; for non-trout waters, not less than 4.0 parts per million.
7. Toxic wastes, oil, deleterious substances, colored or other wastes or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable as a source of water supply for drinking, culinary or food processing purposes or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

NOTE: Refer to Notes 1 and 2 under Class AA, which are also applicable to Class A standards.

CLASS B

Best usage of waters: Bathing and any other usages except as source of water supply for drinking, culinary or food processing purposes.

Quality Standards for Class B Waters

Items	*Specifications*
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. Sewage or wastes effluents.	None which are not effectively disinfected.
3. pH.	Range between 6.5 and 8.5.
4. Dissolved oxygen.	For trout waters, not less than 5.0 parts per million; for non-trout waters, not less than 4.0 parts per million.
5. Toxic wastes, oil, deleterious substances, colored or other wastes or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable for bathing or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

NOTE: Refer to Note No. 2 under Class AA, which is also applicable to Class B standards.

CLASS C

Best usage of waters: Fishing and any other usages except for bathing or as source of water supply for drinking, culinary or food processing purposes.

Quality Standards for Class C Waters

Items	*Specifications*
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. pH.	Range between 6.5 and 8.5.
3. Dissolved oxygen.	For trout waters, not less than 5.0 parts per million; for non-trout waters, not less than 4.0 parts per million.
4. Toxic wastes, oil, deleterious substances, colored or other wastes or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

NOTE: Refer to Note No. 2 under Class AA, which is also applicable to Class C standards.

CLASS D

Best usage of waters: Agricultural or source of industrial cooling or process water supply and any other usage except for fishing, bathing or as source of water supply for drinking, culinary or food processing purposes.

Conditions related to best usage: The waters will be suitable for fish survival; the waters without treatment and except for natural impurities which may be present will be satisfactory for agricultural usages or for industrial process cooling water; and with special treatment as may be needed under each particular circumstance, will be satisfactory for other industrial processes.

Quality Standards for Class D Waters

Items	*Specifications*
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. pH.	Range between 6.0 and 9.5.
3. Dissolved oxygen.	Not less than 3.0 parts per million.

4. Toxic wastes, oil, deleterious substances, colored or other wastes, or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to prevent fish survival or impair the waters for agricultural purposes or any other best usage as determined for the specific waters which are assigned to this class.

NOTE: Refer to Note No. 2 under Class AA, which is also applicable to Class D standards.

CLASS E

Best usage of waters: Sewage or industrial wastes or other wastes disposal and transportation or any other usages except agricultural, source of industrial cooling or process water supply, fishing, bathing, or source of water supply for drinking, culinary or food processing purposes.

Quality Standards for Class E Waters

Items	*Specifications*
1. Floating solids; settleable solids; oil; sludge deposits.	None attributable to sewage, industrial wastes or other wastes in sufficient amounts to interfere with navigation or cause a public nuisance as defined by the Penal Law.
2. pH.	Not lower than 5.0.
3. Dissolved oxygen.	Sufficient dissolved oxygen to prevent odor nuisances due to anaerobic decomposition unless other effective means are used to control odors.
4. Odor producing substances.	None in sufficient amounts to cause a public nuisance as defined by the Penal Law.

CLASS F

Best usage of waters: Sewage or industrial wastes or other wastes disposal.

Quality Standards for Class F Waters

Items	*Specifications*
1. Floating solids; settleable solids; oil; sludge deposits.	None attributable to sewage, industrial wastes or other wastes in sufficient amounts to cause a public nuisance as defined by the Penal Law.
2. Dissolved oxygen.	Sufficient dissolved oxygen to prevent odor nuisances due to anaerobic decomposition unless other effective means are used to control odors.
3. Odor producing substances.	None in sufficient amounts to cause a public nuisance as defined by the Penal Law.

4. Classes and Standards For Tidal Salt Waters

CLASS SA

Best usage of waters: Shellfishing for market purposes and any other usages.

Quality Standards for Class SA Waters

Items	*Specifications*
1. Floating solids; settleable solids; oil; sludge deposits.	None attributable to sewage, industrial wastes or other wastes.
2. Garbage, cinders, ashes, oils, sludge or other refuse.	None in any waters of the Marine District as defined by State Conservation Law.
3. Sewage or waste effluents.	None which are not effectively disinfected.
4. Dissolved oxygen.	Not less than 5.0 parts per million.
5. Toxic wastes, deleterious substances, colored or other wastes or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to edible fish or shellfish or the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, odor or sanitary condition thereof or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.
6. Organisms of Coliform group.	The median MPN value in any series of samples representative of waters in the shellfish growing area shall not be in excess of 70 per 100 milliliters.

CLASS SB

Best usage of waters: Bathing and any other usages except shellfishing for market purposes.

Quality Standards for Class SB Waters

Items	*Specifications*
1. Floating solids; settleable solids; oil; sludge deposits.	None attributable to sewage, industrial wastes or other wastes.
2. Garbage, cinders, ashes, oils, sludge or other refuse.	None in any waters of the Marine District as defined by State Conservation Law.
3. Sewage or waste effluents.	None which are not effectively disinfected.
4. Dissolved oxygen.	Not less than 5.0 parts per million.
5. Toxic wastes, deleterious substances, colored or other wastes or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to edible fish or shellfish or the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color,

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odor or sanitary condition thereof; and otherwise none in sufficient amounts to make the waters unsafe or unsuitable for bathing or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

CLASS SC

Best usage of waters: Fishing and any other usages except bathing or shellfishing for market purposes.

Quality Standards for Class SC Waters

Items	*Specifications*
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. Garbage, cinders, ashes, oils, sludge or other refuse.	None in any waters of the Marine District as defined by State Conservation Law.
3. Dissolved oxygen.	Not less than 5.0 parts per million.
4. Toxic wastes, oil, deleterious substances, colored or other wastes or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to edible fish or shellfish or the culture or propagation thereof, or which in any manner shall adversely affect the flavor, color, odor or sanitary condition thereof or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

CLASS SD

Best usage of waters: Any usages except fishing, bathing, or shellfishing for market purposes.

Quality Standards for Class SD Waters

Items	*Specifications*
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. Garbage, cinders, ashes, oils, sludge or other refuse.	None in any waters of the Marine District as defined by State Conservation Law.
3. Dissolved oxygen.	Not less than 3.0 parts per million.

4. Toxic wastes, oil, deleterious substances, colored or other wastes.	None alone or in combination with other substances or wastes in sufficient amounts to prevent survival of fish life or impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

CLASS I

Best usage of waters: Fishing and any other usages except bathing or shellfishing for market purposes.

Quality Standards for Class I Waters

Items	Specifications
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. Garbage, cinders, ashes, oils, sludge, or other refuse.	None in any waters of the Marine District as defined by State Conservation Law.
3. Sewage or waste effluents.	Effective disinfection if required by Interstate Sanitation Commission.
4. Dissolved oxygen.	An average of not less than 50 percent saturation during any week of the year, but not less than 3.0 parts per million at any time.
5. Toxic wastes, oil, deleterious substances, colored or other wastes, or heated liquids.	None alone or in combination with other substances or wastes in sufficient amounts to be injurious to edible fish and shellfish, or the culture or propagation thereof, or which shall in any manner affect the flavor, color, odor, or sanitary condition of such fish or shellfish so as to injuriously affect the sale thereof, or which shall cause any injury to the public and private shellfisheries of this state; and otherwise none in sufficient amounts to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.

CLASS II

Best usage of waters: All waters not primarily for recreational purposes, shellfish culture or the development of fish life.

Quality Standards for Class II Waters

Items	Specifications
1. Floating solids; settleable solids; sludge deposits.	None which are readily visible and attributable to sewage, industrial wastes or other wastes or which deleteriously increase the amounts of these constituents in receiving waters after opportunity for reasonable dilution and mixture with the wastes discharged thereto.
2. Garbage, cinders, ashes, oils, sludge, or other refuse.	None in any waters of the Marine District as defined by State Conservation Law.
3. Dissolved oxygen.	An average of not less than 30 percent saturation during any week of the year, provided such saturation levels insure adequate oxygen to support fish and shellfish life at all times.
4. Toxic wastes, oil, deleterious substances, colored or other wastes.	None alone or in combination with other substances or wastes in sufficient amounts to be injurious to edible fish and shellfish, or the culture or propagation thereof, or which shall in any manner affect the flavor, color, odor, or sanitary condition of such fish or shellfish so as to injuriously affect the sale thereof, or which shall cause any injury to the public and private shellfisheries of this state.

APPENDIX B

INTERSTATE SANITATION COMMISSION

CLASSES AND QUALITY STANDARDS APPLICABLE

TO DESIGNATED WATERS

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Article VI and Article VII of Article 12-B of the Public Health Law: Tri-State Compact and Interstate Sanitation Commission.

ARTICLE VI

1. It is recognized by the signatory states that, where tidal waters are used for such varied purposes as bathing, navigation, shellfish culture the development of fish life and the disposal of wastes, no single standard of purity is practicable in all parts of the district. In order to attain the objects of this compact, the commission, after proper study and after conducting public hearings upon due notice, shall group the designated water of the district into classes. Where local conditions shall have changed in the future to such an extent that changes in classification become necessary the commission may, after conducting public hearings upon due notice, adopt such changes.

Two general classifications shall be used:

(1) Class "A," in which the designated water areas are expected to be used primarily for recreational purposes, shellfish culture or the development of fish life;

(2) Class "B," in which the designated water areas are not expected to be used primarily for recreational purposes, shellfish culture or the development of fish life.

ARTICLE VII

1. It is agreed between the signatory states that no sewage or other polluting matters shall be discharged or permitted to flow into, or be placed in, or permitted to fall or move into the tidal waters of the district, except under the following conditions and restrictions:

(1) All sewage discharged or permitted to flow into Class "A" waters of the district shall first have been so treated as

(a) to remove all floating solids and at least sixty per centum (60%) of the suspended solids; and

(b) to effect a reduction of organisms of the B. Coli group (intestinal bacilli) so that the probable number of such organisms shall not exceed one per cubic centimeter in more than fifty per centum (50%) of the samples of sewage effluent tested by the partially confirmed test; provided, however that in the case of discharge into waters used primarily for bathing this bacterial standard need not be required except during the bathing season; and

(c) to effect a reduction in the oxygen demand of the sewage effluent sufficient to maintain an average dissolved oxygen content in the tidal waters of the district and in the general vicinity of the point of discharge of the sewage into those waters, at a depth of about five feet below the surface, of not less than fifty per centum (50%) saturation during any week of the year.

2. All sewage discharged or permitted to flow into class "B" waters of the district shall first have been so treated as

(a) to remove all floating solids and at least ten per centum (10%) of the suspended solids, or such additional percentage as may be reason of

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local conditions be necessary to avoid the formation of sludge deposits in the class "B" waters of the district; and

(b) to effect a reduction in the oxygen demand of the sewage effluent sufficient to maintain an average dissolved oxygen content in the tidal waters of the district and in the general vicinity of the point of discharge of the sewage into those waters, at a depth of about five feet below the surface, of not less than thirty per centum (30%) saturation during any week of the year.

APPENDIX C

STATUS OF DISCHARGES IN NEW YORK STATE AREA OF THE HUDSON RIVER AS REPORTED BY NEW YORK STATE HEALTH DEPARTMENT

AUGUST 1965

HUDSON RIVER DRAINAGE BASIN

DISCHARGES REQUIRING CORRECTIVE ACTION

ALBANY COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
Cohoes (C)	20,129	Cohoes	Raw sewage
Watervliet (C)	14,000	Watervliet	Untreated sewage
Albany (C)	126,000	Albany	Untreated and inadequately treated sewage
Green Island (V)	3,533	Green Island	Raw sewage
Menands (V)	2,314	Menands	Raw sewage
Watervliet Arsenal		Watervliet	Plating wastes & oils
Ravena (V)	2,424	Ravena	Inadequate treatment needs secondary
Altamont (V)	1,365	Altamont	Needs secondary treatment
Bethlehem (T) (Delmar, Elsmer S.D.)	10,000	Bethlehem	Needs secondary treatment
Colonie (T) (Latham & Maplewood)	9,500	Colonie	Needs additional treatment
McKownville (H)	500	McKownville	Raw discharges
Coeymans (H)	854	Coeymans	Raw discharges
West Albany S. D.	550	West Albany	Raw sewage
Selkirk (H)	100	Selkirk	Raw discharges
Albany City Water Treatment Plant		Albany	Filter backwash solids
Guilderland State Health Farm		Guilderland	Needs additional treatment

Industries

Manning Paper	Green Island	Paper wastes (Fiber, Color, Organic, Solids)
Alleghany-Ludlum Corp.	Watervliet	Oil & discoloration
Delaware and Hudson	Watervliet	Oil
Tobin Packing Co.	Albany	Meat processing (Organic, Color, Solids)
Mohawk Paper Co.	Cohoes	Solids, fiber, discoloration
Carr Packing Co.	Cohoes	Blood and washings
Behr-Manning	Watervliet	Acids and organics

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RENSSELAER COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
Troy (C)	67,492	Troy	Raw sewage
Pleasantdale (H)	840	Pleasantdale	Raw sewage discharges
Hemstreet Park (H)	480	Hemstreet Park	Raw sewage discharges
Averill Park (H)	711	Averill Park	Raw sewage discharges
Rensselaer (C)	10,506	Rensselaer	Raw sewage
Castleton	1,752	Castleton	Raw sewage
East Greenbush (T)	5,200	East Greenbush	Needs secondary treatment
SD #1			
Hoosick Falls (V)	4,023	Hoosick Falls	Raw sewage
Valley Falls (V)	589	Valley Falls	Raw sewage

Industries

Thompson Mills	Valley Falls	Sanitary, Organic, & Color
F. C. Huyck & Sons	Rensselaer	Felt and Fabrics (Fibers, Colors, & Solids)
Fort Orange Paper Co.	Castletown	Paper Wastes (Fibers, Colors, Organic, Solids, Chemicals)
Loeffel Waste Oil Co.	Nassau	Oil sludge
Ludlow Valve Co.	Troy	Metal Processing (Acids, Alkalies, Solids)
Winthrop-Stearns Corp.	Rensselaer	Drug Manufacturing (Chemicals, Colors, Solids)
General Aniline and Film Corp.	Rensselaer	Dye Wastes (Solids, Color, Chemicals)
Columbia Box Board Mill	Hoosick (T)	Paper Wastes (Fibers, Colors, Organic, Solids)
Wood Flong Corp.	Hoosick Falls (V)	Paper Wastes (Fibers, Colors, Organic, Solids, Chemicals)

GREENE COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
West Coxsackie (H)	500	West Coxsackie	Raw discharges
New Baltimore (H)	400	New Baltimore	Raw discharges
Cairo (H)	500	Cairo	Raw discharges
Cementon (H)	700	Cementon	Raw discharges
Leeds (H)	200	Leeds	Raw discharges
Coxsackie (V)	2,849	Coxsackie	Raw sewage
Catskill (V)	5,825	Catskill	Raw sewage
Athens (V)	1,754	Athens	Raw sewage

COLUMBIA COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
Greenport (T) SD#1	1,800	Greenport	Needs secondary treatment
E. Chatham (H)	200	E. Chatham	Raw Discharges
Germantown (H)	400	Germantown	Raw Discharges
Valatie (V)	1,237	Valatie	Raw Discharges
Philmont (V)	1,750	Philmont	Raw Discharges
Hudson Training School	450	Hudson	Needs secondary treatment
Hudson Training School (Farm Colony)	110	Valatie	Needs secondary treatment
Hudson (C)	11,075	Hudson	Raw discharge

Industries

Columbia Corp.	Chatham	(Color, Solids, Organic) Paper wastes
Kimberly Clark Copr.	Ancram	Tobacco Slurry (Color, Solids, Organic)
Schweitzer Div.		
Prince-High Rock Mills	Philmont	BOD and discoloration
Clermont Fruit Packers	Clermont	Solids and discoloration
Northeast Fruit Growers Coop.	Livingston	Solids and odors

ULSTER COUNTY

Communities and Institutions

Name	Location	Characteristics of Discharges
Chichester H.	Shadaken (T)	Need secondary treatment
Whittier Sewer District	Ulster (T)	Need secondary treatment
Wallkill Sewer District	Shawangunk (T)	Need secondary treatment
New Paltz Village	New Paltz (V)	Need secondary treatment
Saugerties Village EBP	Saugerties (V)	Need secondary treatment
Saugerties Village DUP	Saugerties (V)	Need secondary treatment
Saugerties Village PP	Saugerties (V)	Need secondary treatment
Kingston City	Kingston (C)	Need secondary treatment
Rosendale Village	Rosendale (V)	Raw discharges
Marist Prep. School	Esopus (T)	Need secondary treatment
Kerhonkson H.	Warwarsing (T)	Raw discharges

Industries

Rondout Paper Mills	Warwarsing (T)	Color, solids, turbidity
Martin Cantine Coated Paper Co.	Saugerties (V)	Color from dye and finishing wastes
Ulster County Tissue Mill	Saugerties (V)	Color from dye and finishing wastes
Dall Vechia & Son	Highland	Solids from food processing
Hudson Valley Apple Prod.	Milton	Solids and spent caustic solutions
Hudson Valley Wine Co.	Marlboro	Volatiles from evaporators

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DUTCHESS COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
State Hospital	6,000	Poughkeepsie	Need secondary treatment
Matteawan State Hosp.	3,000	Beacon	Need secondary treatment
Milbrook Village	1,260	Milbrook	Need secondary treatment
Tivoli Village	750	Tivoli	Need secondary treatment
Wappinger Falls	3,500	Wappinger Falls	Need secondary treatment
Arlington Sewer Dist.	6,155	Poughkeepsie	Need secondary treatment
Beacon	17,500	Beacon	Need secondary treatment
Poughkeepsie City	38,330	Poughkeepsie	Need secondary treatment

Industries

Texaco Research Center	Fishkill	Discoloration from petroleum wastes
Orchard Hill Farms	Red Hook	Septic system overflows
DeLaval Separator	Poughkeepsie	No present problem
Western Lithography Co.	Poughkeepsie	Present sewage treatment needs updating

ORANGE COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
Maybrook Village	1,348	Maybrook (V)	Need secondary treatment
Highland Falls - south	500	(V)Highland Falls	Need secondary treatment
Warwick Village	1,500	Warwick (V)	Need secondary treatment
New Windsor SD 12	6,250	New Windsor(T)	Need secondary treatment
Highland Falls - north	4,469	(V)Highland Falls	Need secondary treatment
Cornwall Village	2,000	Cornwall (V)	Need secondary treatment
Cornwall SD 1	2,500	Cornwall (T)	Need secondary treatment
Walden Village	4,851	Walden (V)	Need secondary treatment
Monroe Village		Monroe (V)	Need secondary treatment
Newburgh City	32,000	Newburgh (C)	
Slate Hill	75	Wawyanda (T)	Raw Discharges
Florida Village	300	Florida (V) Wallkill (T)	Raw Discharges
Amchir Sewer Co.			
West Point Summer Camp	1,500	West Point	Need secondary treatment
Washingtonville	800	Washington-ville (V)	Raw Discharges
U. S. Military Academy		West Point	Need secondary treatment

Industries

Perndale Farms	Wallkill (T)	Milky discoloration
Mack Brothers	Goshen (T)	Waste treatment system failing
Monroe Laundry	Monroe (V)	Greyish discoloration
Park Tissue Mills	Salisbury Mills	Solids, turbidity, fibers
Majestic Weaving	Firthcliffe	Fabric process and dye wastes
Am. Felt Co.	New Windsor	Color from fabric processing and sewage
National Gypsum Co.	New Windsor	Discoloration and turbidity from processing

PUTNAM COUNTY

Communities and Institutions

Name	Population	Location	Characteristcis of Discharges
Cold Spring Village	2,083	Cold Spring (V)	Raw Discharge

ROCKLAND COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
Piermont Village	1,500	Piermont (V)	Pump station under construction existing primary plant to be abandoned
Rockland State Hosp.		Orangetown (T)	Deficient secondary treatment
Tappan H.		Orangetown (T)	Raw discharges-sewers under construction
Sparkill H.		Orangetown (T)	Raw discharges-sewers under construction
Upper Nyack Village	732	Upper Nyack (V)	Need secondary treatment
South Nyack Village	3,200	South Nyack (V)	Need secondary treatment
Nyack Village	5,300	Nyack (V)	Need secondary treatment
Haverstraw Village	5,593	Haverstraw (V)	Need secondary treatment
Orangetown SD 2	2,350	Orangetown (T)	Need secondary treatment
Letuchworth Village	4,000	Haverstraw (T)	Need secondary treatment
N.Y.S. Rehabilitation Hosp.	500	(V)West Haverstraw	Need secondary treatment
Sewage Treatment Plant	1,000	(V) West Haverstraw	Need secondary treatment
Iona Island	50	Stony Point (T)	Need secondary treatment
Palisades Interstate Park	5,000	Stony Point (T)	Need secondary treatment
Jewish Home for Convalescents	80	Grandview (V)	Present septic tank inadequate

Industries

Continental Can Co., Inc.	Piermont	White water and equipment wash-up	
Kay-Fries Chemicals, Inc.	Stony Point	Dark gray discoloration	
Elk Piece Dye Corks, Inc.	Garnerville	Dye wastes	
United Wire Goods	Garnerville	Plating rinse waters	
E & S Finishing Co.	Garnerville	Dye rinsing	Receiving stream
Piermont Finishing Co.	Garnerville	" "	blue discoloration
Head Textile Printers	Garnerville	" "	
New York Trap Rock Corp.	Haverstraw	Orange discoloration and turbidity	

WESTCHESTER COUNTY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
Sing Sing Prison	3,000	Ossining	Need secondary treatment
Peekskill City	18,000	Peekskill (C)	" " "
Yonkers STW	440,241	Yonkers (C)	" " "
Briarcliff Manor 2	5,000	Briarcliff (V)	" " "
Ossining Village	2,000	Ossining (V)	" " "
Croton-on-Hudson	3,929	(V) Croton-on-Hudson	" " "
Irvington (V)	4,000	Irvington (V)	" " "
Tarrytown Village	9,800	Tarrytown (V)	" " "
North Tarrytown Village	9,100	(V) North Tarrytown	" " "
Ossining Village WAT	14,000	Ossining (V)	" " "
Briarcliff Manor 1	125	Briarcliff (V)	" " "
Franklin Roosevelt V.A. Hospital	3,000	Cortlandt (T)	" " "
St. Joseph's Home	500	Peekskill (C)	Raw Discharge
N.Y.S. Military and Naval Affairs	2,400	Cortlandt (T)	Need secondary treatment

Industries

Refined Syrup & Sugars, Inc.	Yonkers	Turbidity, color, sludge from sewage and wastes
Chev. Div. of General Motors, Inc.	Tarrytown	Color & oil from metal washing & paint spraying
Hudson Wire Co.	Ossining	Plating & pickling wastes
Barlow Chemical Corp.	Ossining	Process wastes from production of synthetic chemicals
New York Central R.R. Co.	Harmon	Oil filter cleaning & shop wastes
Standard Coated Products	Buchanan	Turbidity color & sludge from sewage and wastes
Standard Brands, Inc.	Peekskill	Color from yeast fermentation and vinegar
Cortland Stone Co.	Peekskill	Turbidity from dust control
The Ednalite Optical Co.	Peekskill	Turbidity and oil from grinding processes

NEW YORK CITY

Communities and Institutions

Name	Population	Location	Characteristics of Discharges
Manhattan: Battery	700,000	Manhattan	Raw sewage
to Harlem River	50,000	"	Have screening - need secondary treatment

APPENDIX D

POLLUTION TRENDS IN THE HUDSON RIVER

AT A POINT

BELOW POUGHKEEPSIE, N. Y.

WATER POLLUTION SURVEILLANCE STATION NO. 18

August 25, 1965

POLLUTION TRENDS IN THE HUDSON RIVER AT A POINT BELOW POUGHKEEPSIE, NEW YORK

Introduction

The PHS has, since July 1958, maintained a Water Pollution Surveillance System station in the Hudson River below Poughkeepsie. The International Business Machines Corporation has participated in the operation of this station. This report summarizes and evaluates water quality data collected to date.

Hydrology

The water pollution surveillance station below Poughkeepsie is located about 70 miles above the mouth of the Hudson River as shown on Figure 1.

The station is located within the tidal reach of the river. The river is affected by semidiurnal tides to Troy Lock and Dam, some 75 miles upstream from Poughkeepsie. Daily tidal ranges vary from 3 to 6-1/2 feet in New York Harbor and from 4-1/2 to 6-1/2 feet at Albany.

The Hudson River estuary has been characterized (1)* as partially mixed where the salinity and density increase with depth. The horizontal salinity distribution shows an increase from the head toward the mouth at any given depth.

Flows are gaged at Green Island, just upstream from Troy Lock and Dam. The tributary area at the gage is about 85% of that at the pollution surveillance station. Figure 2 compares historical and recent flows reported by the U. S. Geological Survey (2,3,4). Average annual flows for the 13-year base period were 13,225 cfs. The figure reveals the sustained periods of minimum flows during water years 1964 and 1965.

Water Quality

Figure 3 shows levels, variations, and trends in dissolved oxygen concentration and saturation values. Throughout water years 1960 through

* Numbers in parentheses refer to References following Appendix D

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Figure 1

Map of Hudson River, New York Harbor to Kingston

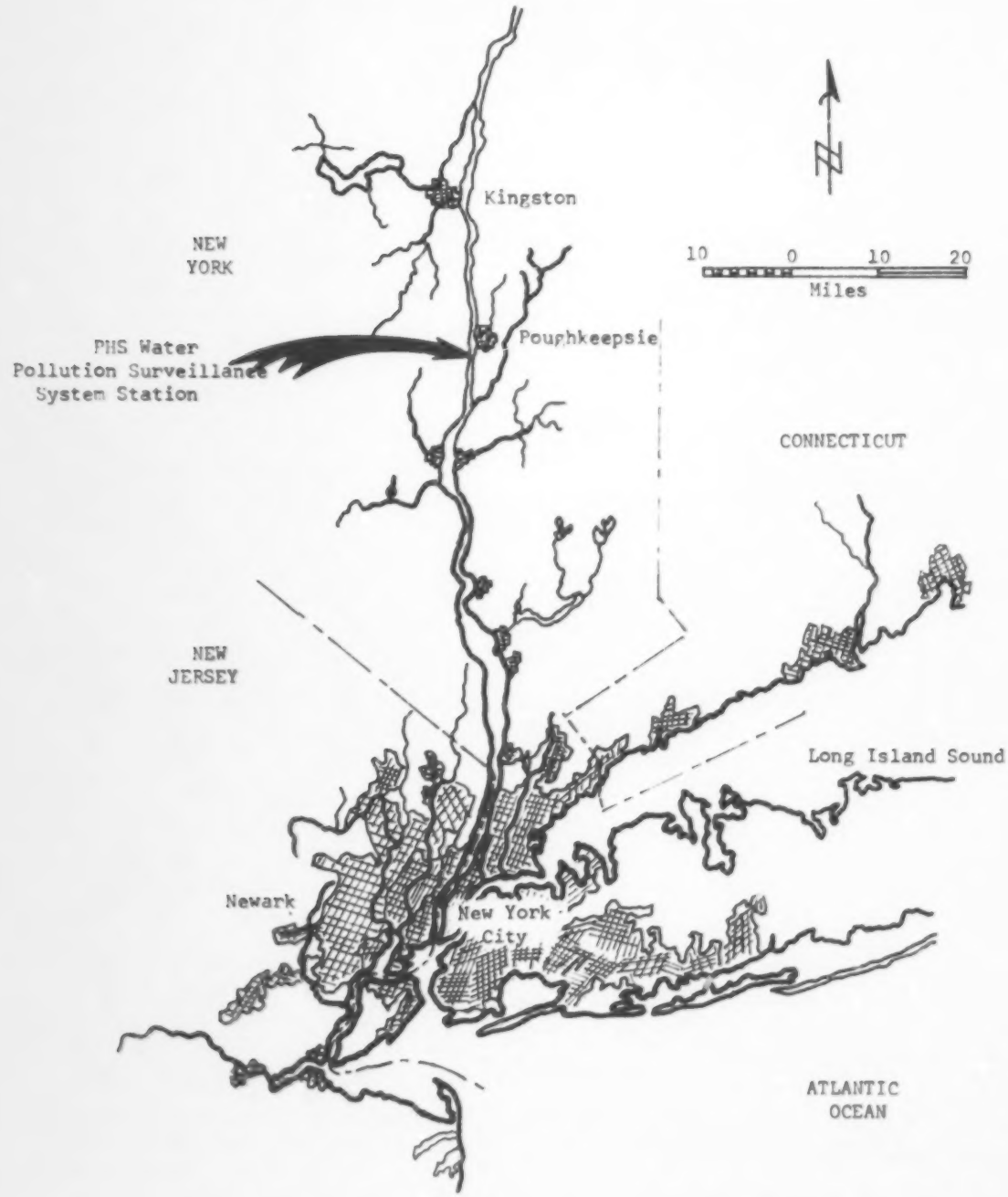


Figure 2

Streamflows, Hudson River at Green Island,

Comparison of Water Years 1964 and 1965

with Prior 13 Year Record

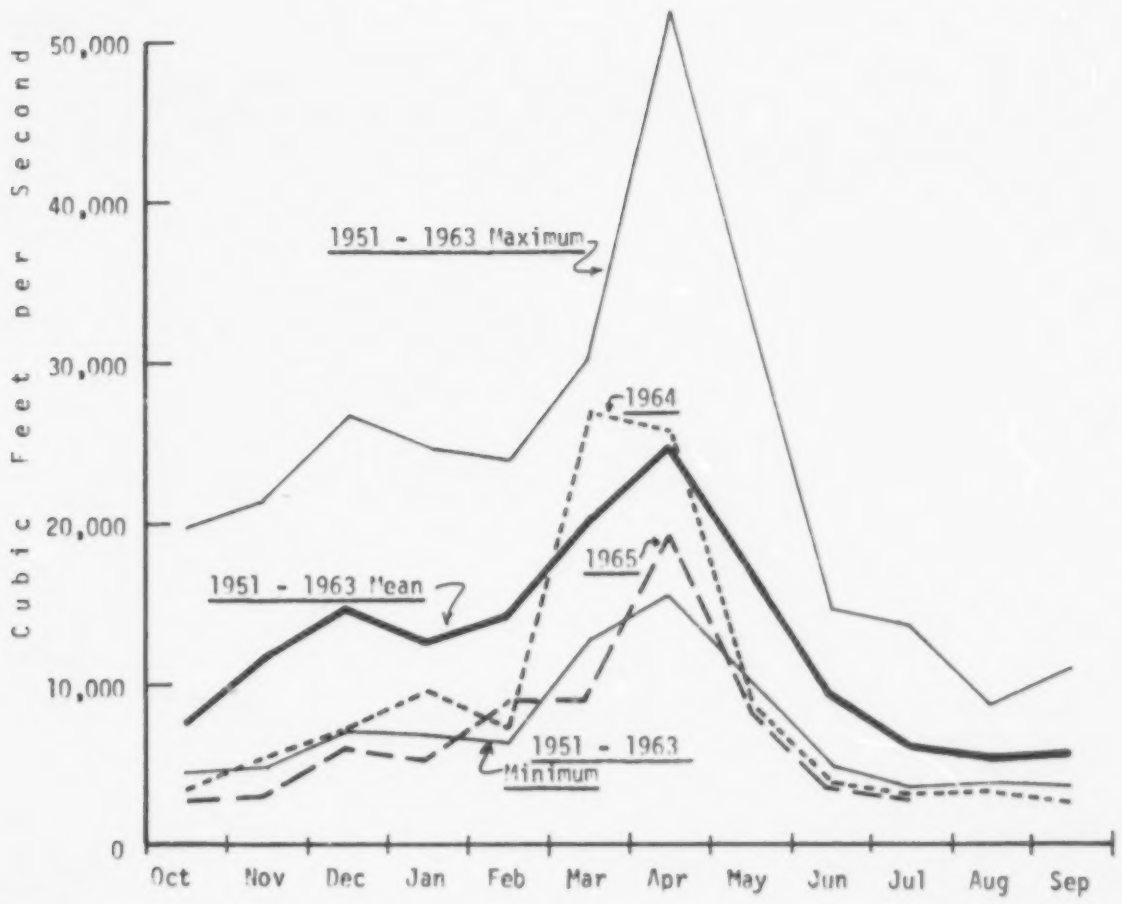
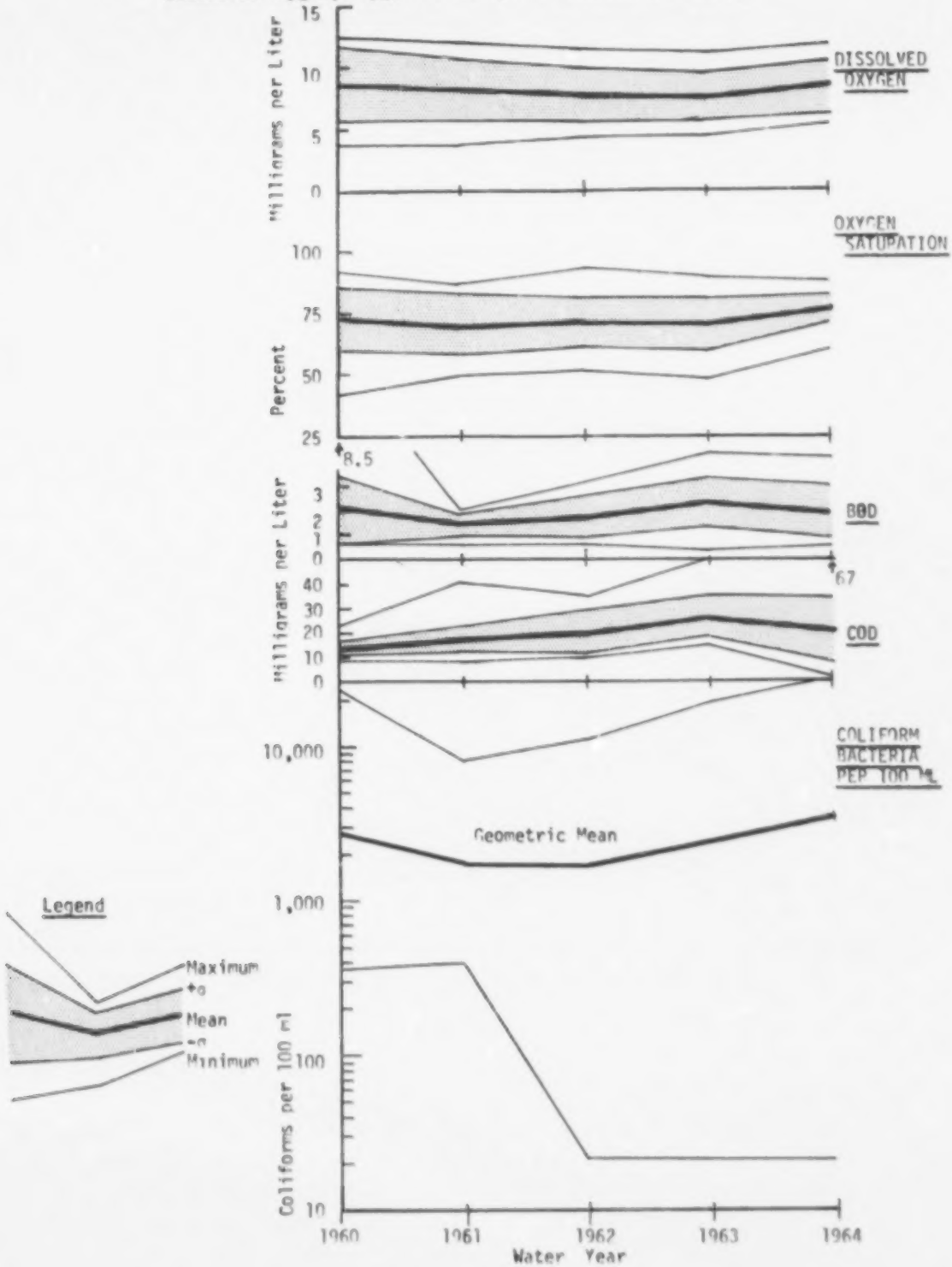


Figure 3
Dissolved Oxygen, Oxygen Demands, and Coliform Bacteria



1964, concentrations were generally between 6 and 12 mg/l, corresponding to saturation values of from about 60 to 85 percent. BOD's were low, ranging from about 0.6 to 3.4 mg/l. There was an increasing trend in COD which averaged 14 mg/l in WY-1960 and 22 mg/l in WY-1964. Geometric means of coliform bacteria concentrations approximately doubled between WY-1962 and WY-1964, with maximum values indicating a rather high pollution level.

Figure 4 shows levels and variations in chloride, sulfate, alkalinity, and hardness. During water years 1963 and 1964, there has been a marked increase in chloride, moderate increases in hardness and alkalinity, and no significant change in sulfate concentrations. Some of the increases are probably related to the normal inverse relationship between concentrations of mineral constituents and flow. The relationships of these changes to the stream flow indicates the intrusion of salt water during low flow periods.

Figure 5 shows a comparison of recent chloride and sulfate concentrations with those of previous years. Chlorides began to rise in late September 1964 when average flows had been less than 4,000 cfs for about three months (see Figure 2). Chlorides remained high until early December when the flows increased. The short-term chloride variability during the September-December period was probably related to semidiurnal and fortnightly tides, although these data do not permit resolving the relative effects of the two tides.

Comparison of Figures 2 and 5 indicates that a similar, possibly greater, increase in chlorides is a virtual certainty again this year because of the longer period of even lower flows than those of 1964.

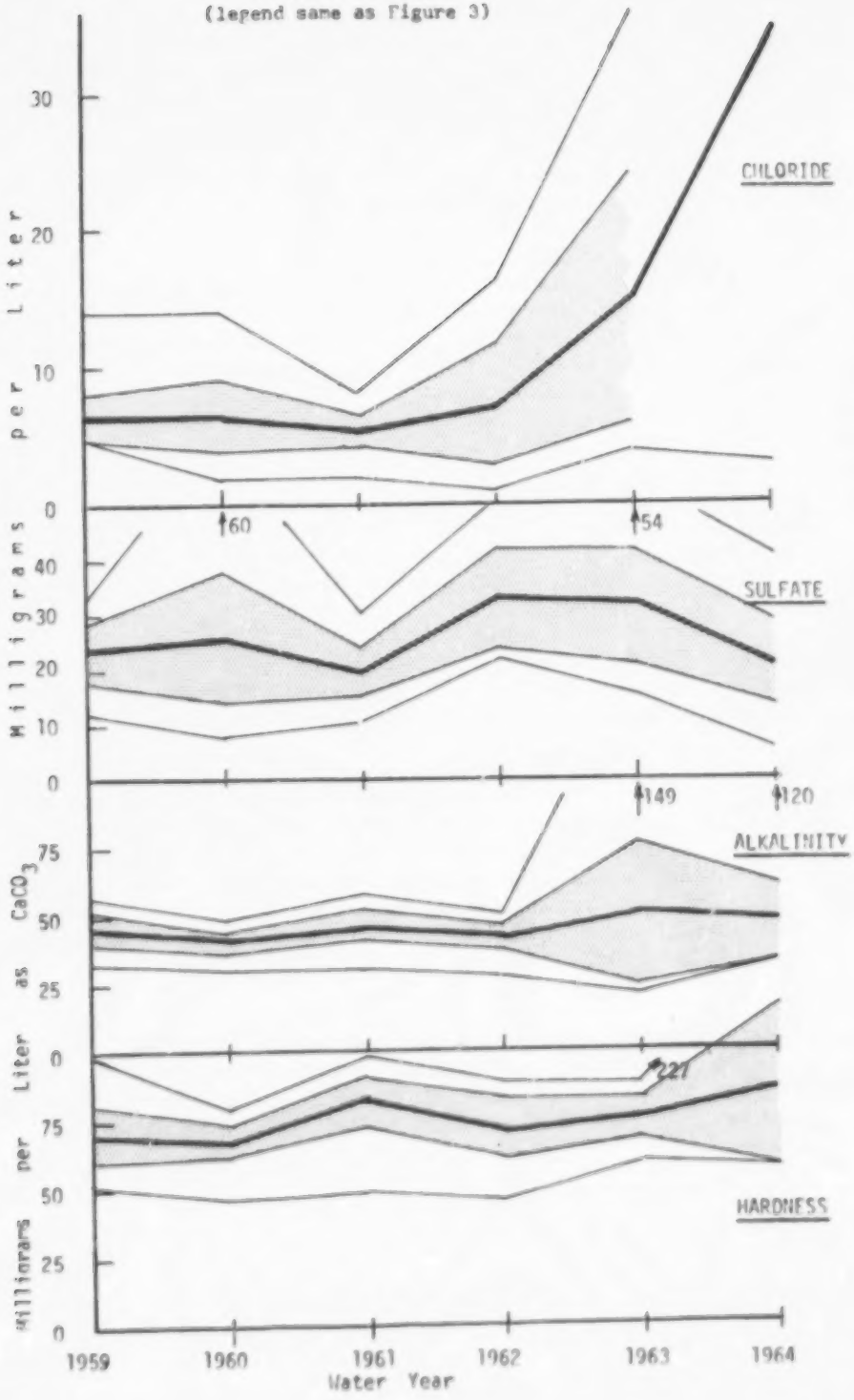
The lack of an increase in sulfates similar to that for chlorides is noteworthy. The normal ratio of sulfate to chloride in sea water is 0.14. The maximum chloride concentration of 605 mg/l found on November 25, 1964 corresponds to about 3% sea water. On this basis, and assuming a sulfate level of 25 mg/l in the river, a resulting sulfate concentration of 100 mg/l would be expected. The difference between the expected and observed values probably reflects the reduction of sulfate during the period of travel, measured in months, within anaerobic bottom waters of the lower estuary.

Concentrations of minor constituents are listed in Table 1. These are based on four composited samples collected between October 1962 and September 1964. In addition to those listed, sodium varied from 5.9 to 52 mg/l, potassium from 0.09 to 4.0 mg/l, and fluoride from 0.015 to 0.26 mg/l.

Figure 4

Mineral Quality

(legend same as Figure 3)



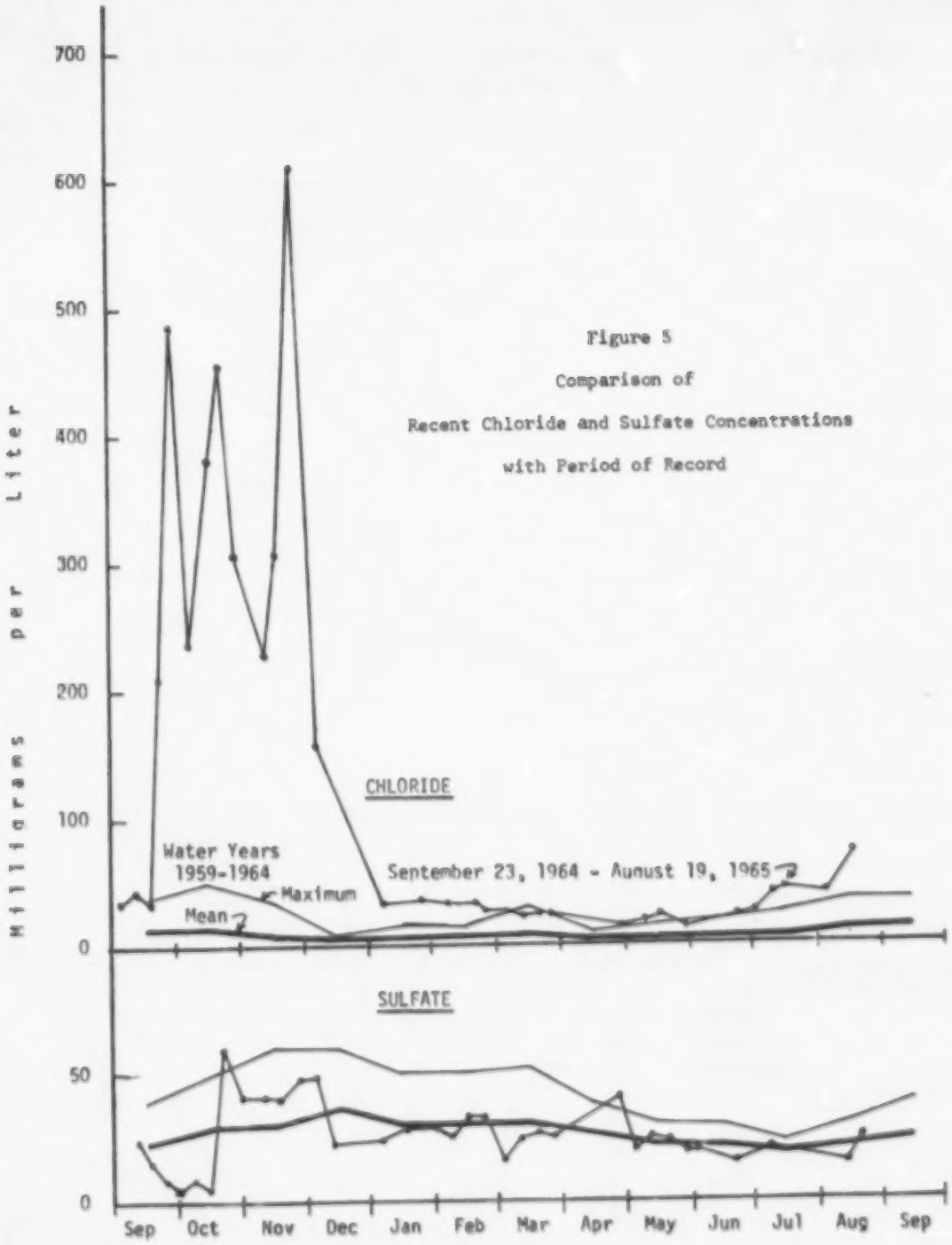


Figure 5

Comparison of

Recent Chloride and Sulfate Concentrations

with Period of Record

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Table 1

OCCURRENCE OF MINOR CONSTITUENTS IN HUDSON RIVER AT POUGHKEEPSIE
October 1962-September 1964

	Percent Occurrence	Average Concentration of Positive Samples ug/l	Minimum Level of Detectability ug/l
Zinc	100	57	-
Cadmium	0	-	1.0
Arsenic	0	-	10
Boron	100	34	-
Phosphorus	75	23	4.0
Iron	100	58	-
Molybdenum	25	9	2.0
Manganese	75	2.1	0.8
Aluminum	100	32	-
Beryllium	0	-	0.03
Copper	100	11	-
Silver	0	-	0.3
Nickel	0	-	1.0
Cobalt	0	-	1.0
Lead	50	10	3.0
Chromium	75	6	3.0
Vanadium	0	-	2.0
Barium	100	26	-
Strontium	100	103	-

Figure 6 summarizes the physical and radiological quality of the water. pH is generally between 7.0 and 7.6 with higher values in recent years. Turbidity and suspended solids also showed increasing trends during the record period, although the levels are still low.

Beta activity, particularly in the dissolved fraction, followed the normal pattern for the conterminous United States resulting from nuclear weapons testing (5). Strontium-90 values were also in accord with those from other stations and well within limiting values established by the National Council for Radiation Protection (6). Strontium-90 levels observed to date are listed in Table 2.

Figure 6
Physical and Radiological Quality
(legend same as Figure 3)

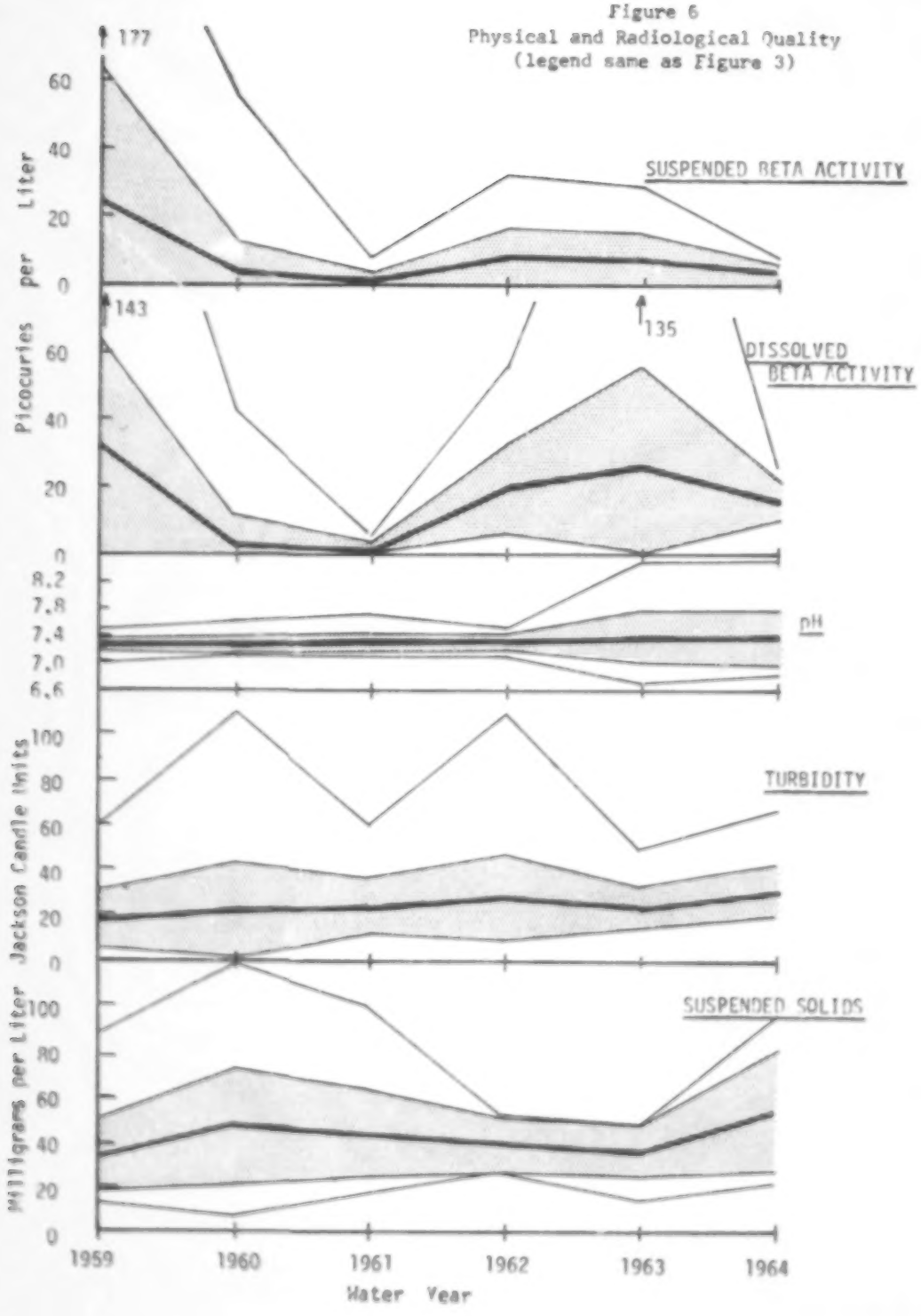


Table 2

STRONTIUM-90 IN HUDSON RIVER BELOW POUGHKEEPSIE, NEW YORK
Picocuries per Liter

Water Year	Oct.-Dec.	Jan.-March	April-June	July-Sept.
1959	-	4.5	1.1	1.0
1960	1.3	1.7	0.7	0.1
1961	0.4	0.4	0.51	0.24
1962	2.5	1.07	1.66	-
1963	3.02	-	3.81	-
1964	5.03	-	2.07	-
1965	2.03	-		

Selected carbon adsorption method and grab samples have been analyzed for organic materials. To date, only samples from the low-flow month of September have been examined. Specific identifications of organic materials have been limited to chlorinated hydrocarbon pesticides. Table 3 shows that dieldrin was always present. Similarly, evidence of endrin, DDE, DDD, and lindane was found more than half the time. There were occasional indications of lindane and heptachlor epoxide. DDT and heptachlor were never found. In all cases, the concentration levels were very low.

Figure 7 shows the population levels and dominant genera of plankton algae. Table 4 lists the genera according to the code shown on the figure.

Figure 7 shows that plankton levels are generally low and dominated by the centric diatoms Cyclottella and Melosira. The single high count which has been found to date was due to a bloom of Coccochloris.

Table 3

OCCURRENCE OF CHLORINATED HYDROCARBON PESTICIDES
IN THE
HUDSON RIVER BELOW POUGHKEEPSIE

Concentrations in picograms per liter (parts per trillion)[a]

Dates(s)[b]	9/3-10/58	9/2-9/59	9/7-15/60	9/11-21/61	9/5-17/62	9/20-30/62	9/23 1964
Dieldrin	<1	<1	<1	<1	<1	<1	8
Endrin	P	<1	<1	<1	ND	ND	ND
DDT	ND	ND	ND	ND	ND	ND	ND
DDE	<1	<1	<1	P	P	ND	4
DDD	<1	<1	<1	ND	<1	<1	ND
Aldrin	ND	ND	ND	P	ND	ND	P
Heptachlor	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	ND	ND	ND	ND	P	ND	ND
Lindane	P	P	ND	ND	P	P	ND

ND - Not detected.
P - Presumptive. Results of chromatography were highly indicative but did not meet all requirements for positive identification.

Note:

a. Concentration values shown for carbon adsorption method samples are calculated from quantitative gas chromatographic analysis of the aromatic fractions of the carbon chloroform extract, and may be assigned the units of picograms per liter. In light of the unknown efficiency of carbon adsorption sampling for these compounds, the reported values represent minima, the actual values being equal to or greater than the reported values.

b. Dates indicate beginning and ending of carbon filter runs except for grab sample collected 9/23/64.

Figure 7

Plankton Algae and Dominant Genera (see text for key to code numbers)

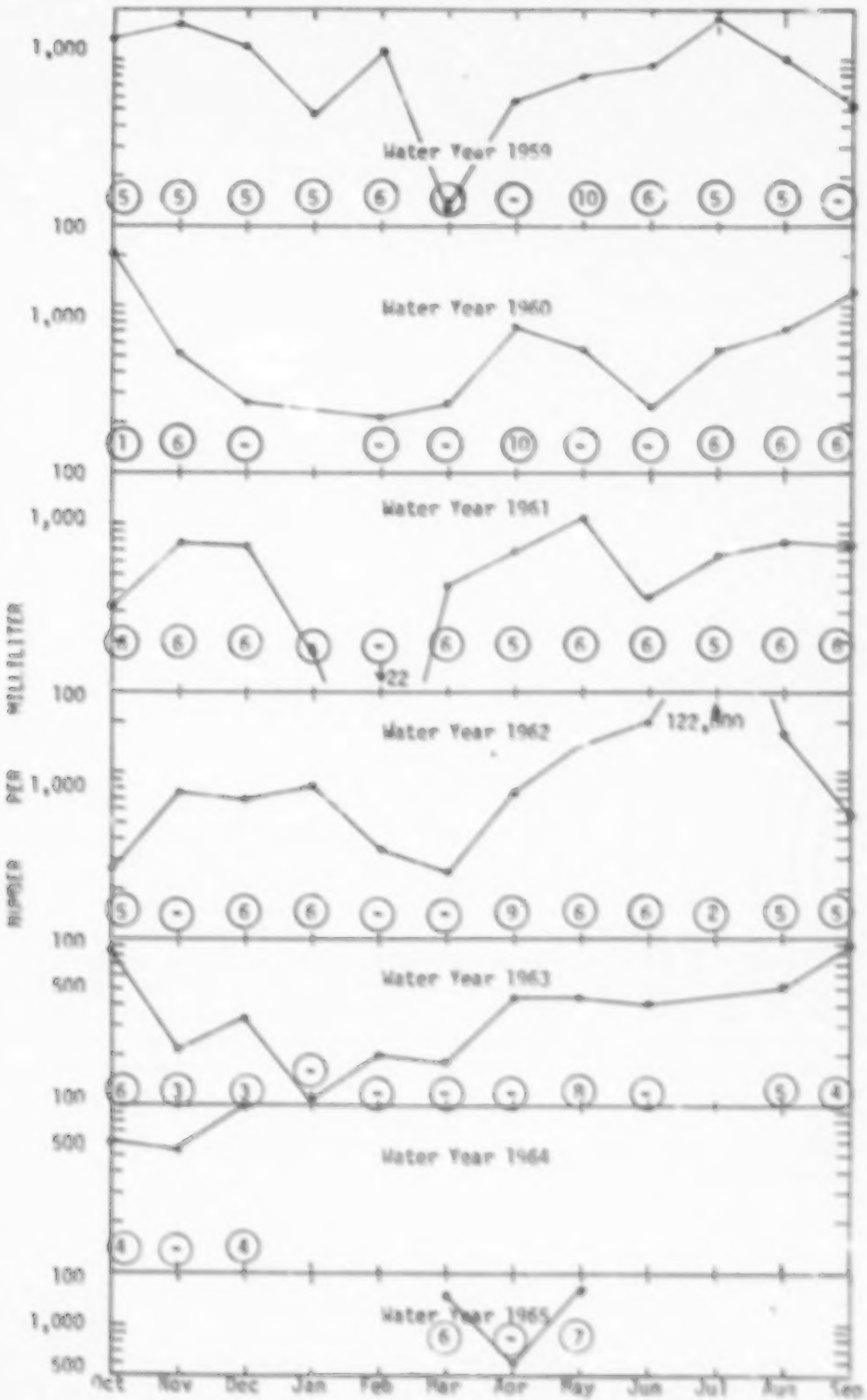


Table 4

KEY TO GENERA OF PLANKTON ALGAE

No.	
	Blue-green algae
1	Anacystis (microcystis)
2	Coccochloris
	Coccoid-green algae
3	Ankistrodesmus
4	Scenedesmus
	Centric diatoms
5	Cyclotella
6	Melosira
7	Stephanodiscus
	Pennate diatoms
8	Asterionella
9	Diatoma
10	Synedra

Summary

Examination of Water Pollution Surveillance System data for the Hudson River below Poughkeepsie for the period from 1958 to the present reveals the following:

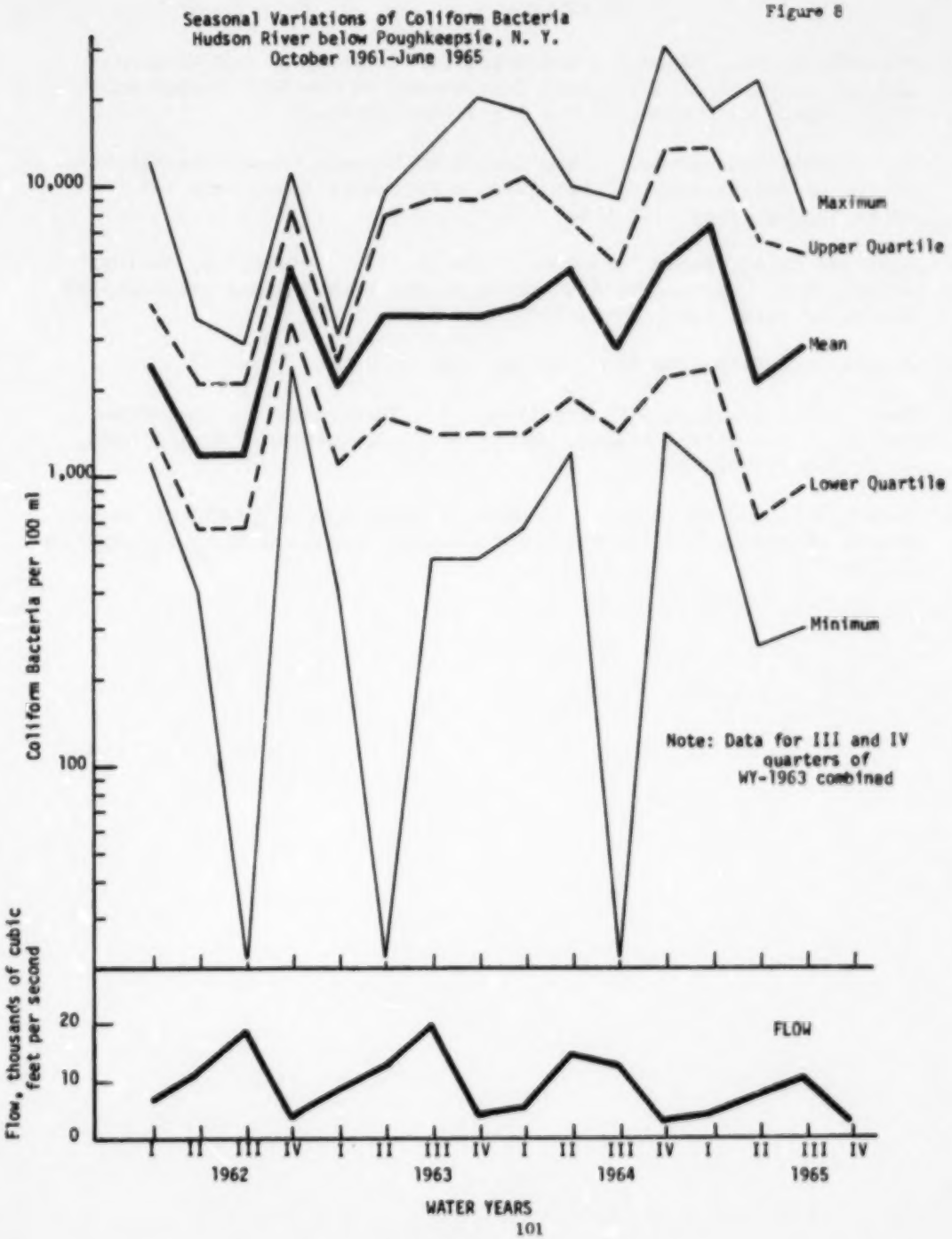
Dissolved oxygen levels were generally between 6 and 12 mg/l, BOD varied from about 0.6 to 3.4 mg/l, and COD increased to an average of 22 mg/l in WY-1964. Coliform bacteria levels indicate significant pollution.

The recent drought caused large increases in chlorides during the fall of 1964 due to sea water intrusion; this is expected to be repeated in 1965. Concurrent increases in sulfate were not found, suggesting that sulfate reduction took place in the lower estuary.

Surveillance for trace constituents, radioactivity, and plankton showed levels and variations generally consistent with those for eastern streams. A single plankton bloom due to the blue-green algae, Coccochloris was found. Chlorinated hydrocarbon pesticides were present in all samples examined but at very low concentrations.

Figure 8 shows a further examination of coliform bacteria below Poughkeepsie, New York.

Figure 8


Seasonal Variations of Coliform Bacteria
Hudson River below Poughkeepsie, N. Y.
October 1961-June 1965
10,000
1,000
100
Coliform Bacteria per 100 ml
Maximum
Upper Quartile
Mean
Lower Quartile
Minimum
Note: Data for III and IV quarters of WY-1963 combined
Flow, thousands of cubic feet per second
20
10
0
FLOW
I II III IV I II III IV I II III IV I II III IV
1962
1963
1964
1965
WATER YEARS

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